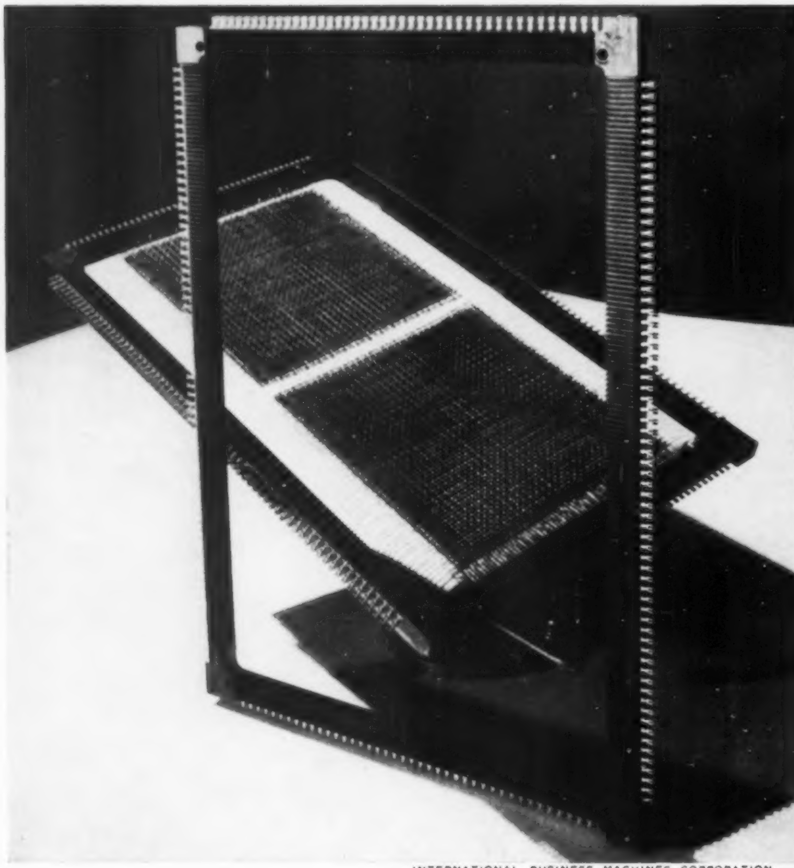
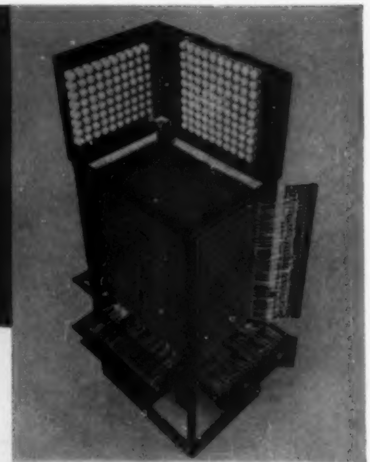
MODERN PLASTICS

AUGUST 1959



INTERNATIONAL BUSINESS MACHINES CORPORATION



MODERN ABACUS enables man to string words and numbers on wire like beads and pick them off again in millionths of a second. Durez phenolic is used to frame the thousands of ferrite cores in IBM magnetic data-storage unit. In an array of core planes stacked atop one another, electrical impulses alter the magnetic state of cores. A line of cores, some altered, some neutral, stands for a word or number, awaiting the impulse that releases it for calculation.

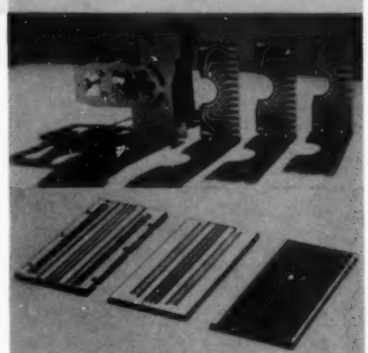
Material for a jet-age abacus

Engineers needed a non-warping material for the frame that supports thousands of tiny ferrite cores, heart of the magnetic "memory" in IBM data-processing systems.

Requirements were stiff. The frame must be an excellent insulator. It must be free of internal stress that would cause warping or cracking. During assembly it must withstand the blistering heat of dip soldering without losing its dimensions. Once assembled, it must not shrink or expand.

The material finally selected for this job is a Durez phenolic. Mineral-filled, it has a low molding shrinkage of 0.003 in./in. that minimizes stress and strain. Its water absorption is a low 0.2%. It stands temperature of 325°F under ASTM D648—easily survives the soldering operation. Its electrical properties, including arc resistance, meet every requirement.

This is only one more example of a host of jet-age assignments handled with the new Durez phenolics. You can do more—meet today's needs better than ever before—with this wide-ranging family of materials. Thermal stability, electrical properties, impact strengths are up; costs are attractively low. To get an idea of the new latitude Durez phenolics give you, write for illustrated Bulletin D400.



IN OTHER IBM. EQUIPMENT Durez phenolics prove their inborn versatility. Molded circuits employ a Durez mineral-filled compound in stepping switches and emitter for card-feed unit of an accounting machine.

DUREZ PLASTICS DIVISION

1208 WALCK ROAD, NORTH TONAWANDA, N. Y.

HOOKER CHEMICAL CORPORATION

HOOKER CHEMICALS PLASTICS

MODERN

*

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PLASTICS*

AUGUST 1959
Volume 36 Number 12

• ENGINEERING

• TECHNICAL

• DEPARTMENTS

Coming Up

The matter of resistance to flame continues important in the plastics (particularly the thermoplastics) picture. Literally, any plastic can be made flame resistant, chiefly by the use of halogen additives. But what happens to the other properties of the thermoplastics when they are so treated? What happens to production rates? What happens to color? Our September lead will explore this situation. . . . Some exciting new plastics sandwiches are being studied by the construction industry. They bring new dimensions to architecture and decor. A major feature in September will show one line of these materials. . . . The extruder becomes constantly more important as a plastics processing tool, and automation of the extruder is the next big step. An engineering section article for September will discuss improved instrumentation for the process. . . . Engineering section will also carry the final article in the series of four on how to overcome problems with premix molding.

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*Reg. U.S. Pat. Off.

Speed... Precision... Versatility

DAKE

Reinforced Plastic Molding Presses

GUIDED PLATEN—Assures accurate alignment.

AUTOMATIC, SEMI-AUTOMATIC, OR MANUAL CONTROL—For production or experimental work.

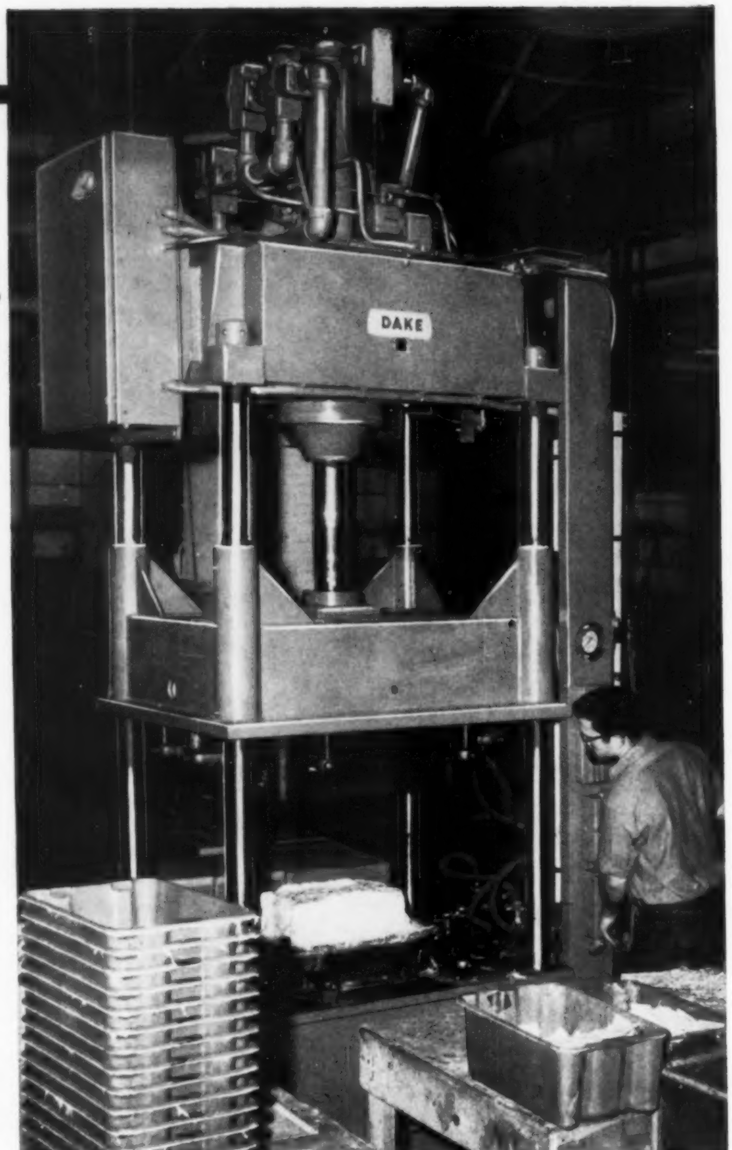
FAST RAM APPROACH—Allows for fast closing and return of movable platen. Slows automatically as work is approached.

ACCURATE, CONTROLLED PRESSURES—Give maximum on-the-job flexibility.

ELECTRIC TIMER—Holds pressure during curing cycle—adjustable from 3 seconds to 20 minutes. Ram returns automatically.

ADJUSTABLE STROKE CONTROL—Provides for automatic ram slowdown before contacting work.

ADJUSTABLE PRESSURE—From 1/3 press capacity to full press capacity.



75-Ton Dake Guided Platen Plastic Molding Press forming Stack-n-Nest tote pans at G. B. Lewis Company, Watertown, Wisconsin.

Dake Guided Platen Presses are the latest development in the reinforced plastic molding field. They are job engineered to help you meet all molding requirements, as well as speed production output, and reduce operating costs. Their all-steel construction with long tie rod bearings and larger diameter tie rods provide maximum rigidity to assure extremely accurate work with all types of plastic forms. Standard models are electric-hydraulic in operation and available in capacities from 25 tons to 600 tons. Write for Bulletin 405.

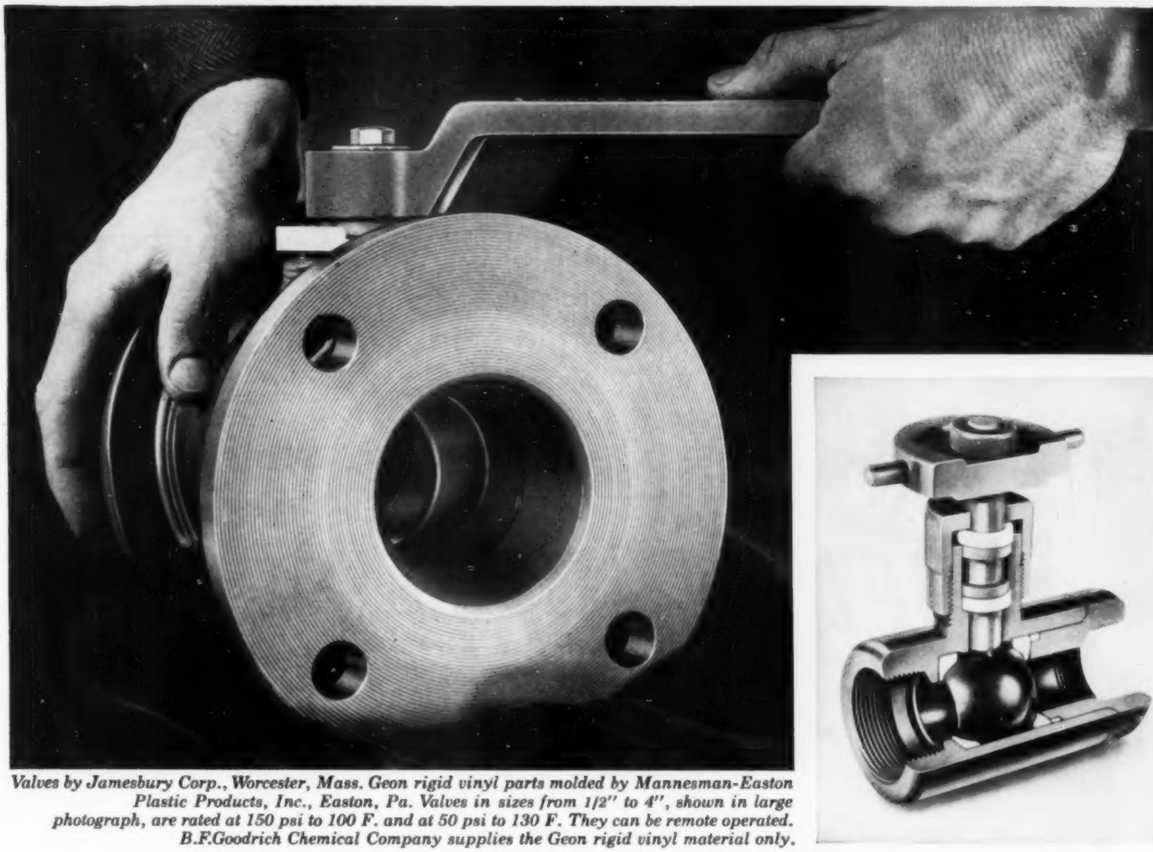
Hand-Operated Hydraulic | Power-Operated Hydraulic | Guided Platen | Gap Type Presses | Movable Frame

DAKE PRESSES

DAKE CORPORATION
648 Robbins Road
Grand Haven, Mich.

News about

B.F.Goodrich Chemical *raw materials*



Valves by Jamesbury Corp., Worcester, Mass. Geon rigid vinyl parts molded by Mannesman-Easton Plastic Products, Inc., Easton, Pa. Valves in sizes from 1/2" to 4", shown in large photograph, are rated at 150 psi to 100 F. and at 50 psi to 130 F. They can be remote operated. B.F.Goodrich Chemical Company supplies the Geon rigid vinyl material only.

New ball valve of Geon helps piping systems fight corrosion

Thousands of test cycles with this new valve made from Geon rigid vinyl have proved the effectiveness of its seal, either at full pressure or vacuum. Since it is made entirely of Geon except for seats and seals, it offers pipe users another weapon for the battle against corrosion. Geon offers superior resistance to oils, acids, alkalies and most chemicals.

In addition, rigid Geon weighs less than metal. Shipping weights are lower, installation is easier. These valves can be obtained with threaded ends, weld ends, or flanges. They are self-compensating for changes in pressure or temperature. There is no problem of galling or seizure. No lubrication is needed.

Geon offers remarkably varied opportunities for products that open new markets or improve present applications. In rigid form it is being used for pipe, window frames and ductwork . . . in other forms for weatherstrip, wall coverings, foam products, or coatings for metal, paper or textiles. One member of the Geon family can surely help you make a better product. Write for information to Dept. AF-6, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

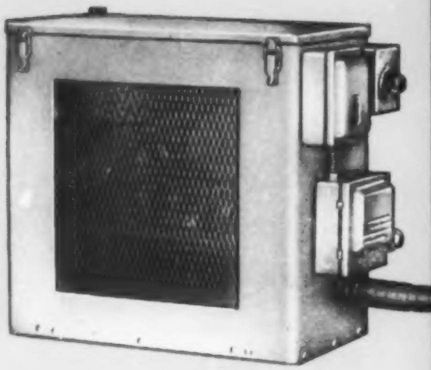
Geon
Polyvinyl Materials

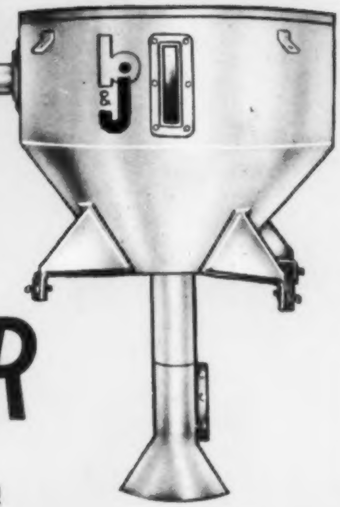
B.F.Goodrich Chemical Company
a division of The B.F.Goodrich Company

B.F.Goodrich

GEON polyvinyl materials • HYCAR rubber and latex
GOOD-RITE chemicals and plasticizers • HARMON colors

the money you save by eliminating rejects will pay for a





NEW B & J HEATER-DRYER

(HOPPER ATTACHMENT)

NEW DESIGN! MORE EFFICIENT! MORE COMPACT!

The newly designed B & J Heater-Dryer will give you more full shots, better surface quality and improved physical properties with a greatly reduced reject rate that will save you money. In fact, the elimination of rejects will save you enough money to pay for a B & J Heater-Dryer that will condition, dry, and pre-heat the material right in the hopper of your injection molding or extruding machine. The Air-Maze filter, with washable filter element, removes dust and dirt from the air. The round B & J Hopper eliminates "dead" spots... heat is spread uniformly ... moisture is dispersed faster. You get positive control of temperature from 150° to 235°F ... with no chance for heat loss or contamination as can occur in transferring materials from drying ovens.

CONTINUOUS, AUTOMATIC OPERATION

You don't need floor space for a B & J Heater-Dryer. It attaches to the hopper of your injection molding machine or extruder ... eliminates double handling of the material ... provides continuous, automatic operation. Just load material into the B & J Hopper—that's all! You'll have a better product, fewer rejects, and increased production.

WANT MORE INFORMATION? *Write today for Bulletin D558. It describes the B & J Heater-Dryer in detail. Also ask for our 8-page reprint of the results of a quantitative study of pre-heating polyethylene and impact polystyrene before extrusion.*

B & J HEATER-DRYER ELIMINATES THESE COMMON CAUSES OF DEFECTS

DEFECT	CAUSE
Short shots	Material temperature too low
Bubbles or surface blisters	Material insufficiently dried
Poor welds, flow marks	Material too cold
Brittleness	Improper welding due to cold material
Moist surface or cloudiness	Material too cold, material improperly dried

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BALL & JEWELL, INC.

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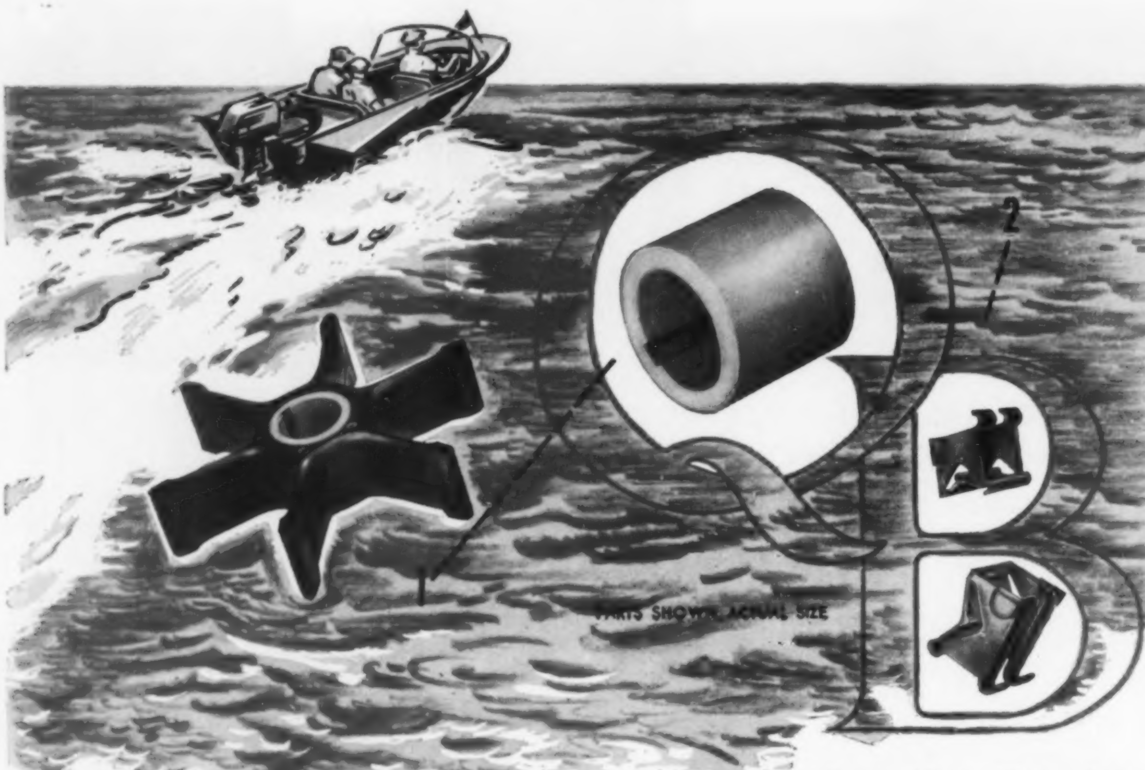

These tough molded Thermoplastic Parts Laugh at Salt Water

They're by Quinn-Berry, of course!

"WHERE THE UNUSUAL IS ROUTINE"

Here are two good examples of Quinn-Berry contributions to the improvement of end products.

1 At the left above is the Quinn-Berry molded nylon pump impeller insert used in Evinrude's 50 hp. Starflite motor. The dimensional stability of molded nylon affords tough resistance to thrust and shear stresses at all temperatures . . . and nylon is unaffected by salt water. It will not corrode.

2 Evinrude uses the molded nylon combination bearing and detent spring (above right) in the 10 hp. and 18 hp. motors to control the position of the choke. This Quinn-Berry molded part requires a minimum of lubrication, has excellent wearing characteristics and salt water will not corrode it.

Consult with us on your component parts design and material requirements. Quinn-Berry molded thermoplastics are doing a good job in a wide diversity of applications.

CHELSEA 50, Mass.
Joseph Leeder
68 Marlborough Street
Chelsea 3-3484

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Room 211
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Ambassador 2-6005

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Harry R. Brethen Co.
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Diamond 1-3454

EAST ROCHESTER, N. Y.
Dynatherm, Inc.
607 West Commercial Street
Phone: Ludlow 6-0082

KNOXVILLE, Tennessee
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Phone: 2-5911

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WE FLY TO SERVE YOU FASTER!

QUINN-BERRY CORP.

2609 WEST 12TH STREET, ERIE, PA.

Opacity

Du Pont Chrome Yellow Medium Y-469-D

and Molybdate Orange YE-421-D offer excellent blending properties, high opacity

A complete range of shades—from brilliant yellow to deep orange—can be produced with these outstanding pigments. Both Chrome Yellow Medium Y-469-D and Molybdate Orange YE-421-D offer high opacity and excellent blending properties.

These economical pigments also have outstanding lightfastness and they resist migration and crocking. They are suitable in most applications where heat stability is an important factor.

For full information about these quality pigments, contact your Du Pont Pigments Representative, or write: E. I. du Pont de Nemours & Co. (Inc.), Pigments Department, Wilmington 98, Delaware. In Canada: Du Pont of Canada Limited, P. O. Box 660, Montreal, Quebec.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

DU PONT

REG. U. S. PAT. OFF.

ENGINEERED NYLON PRODUCTS, INC.

***Reduced overall cycle time* 32%**

***and cut production costs* 25%**

with a

MOSLO

Model 75-4

FULLY AUTOMATIC

MOLDING MACHINE

Here's what they say...

2530 BY-PASS ROAD P.O. BOX 753 PHONE 4-1260 ELKHART, INDIANA

specialists in molded nylon and thermoplastic products

engineered nylon products, inc.

enp enp

Moslo Machinery Company
2442 Prospect Avenue
Cleveland, Ohio

April 1, 1959

Att: Mr. P. Sorensen

Gentlemen:

Several months ago we installed our first Moslo Model 75-4 Injection Press after a rather intensive survey of the equipment offered by various manufacturers and exhibited at the Chicago show last fall As you know, we are specialists in the molding of industrial nylon products, and we were looking for equipment that would not only afford increased production speeds but also would provide a wide range of precision controls over the molding characteristics of our products We are sure that you would be interested in knowing of the results we have been able to obtain on this equipment.

One of the most notable features of this machine has been found in the heating cylinder where we can now obtain excellent heat dispersion without over-heating the material. This improvement results in moldings which retain more strength characteristics than we have been able to obtain on our other machines, thereby providing us with definite quality improvement in our products.

The precise control possible on this cylinder, combined with other features of the machine, such as fast-acting moving platen, simplified mold set-up and reduced scrap shots, have combined to give us impressive manufacturing cost reductions -- in several cases as much as 20% and 25%. We feel that these results justify the purchase of additional equipment from you as we proceed with our planned improvement program on manufacturing facilities.

Very truly yours,
ENGINEERED NYLON PRODUCTS, INC.

William C. Holden

William C. Holden,
Vice President & General Manager

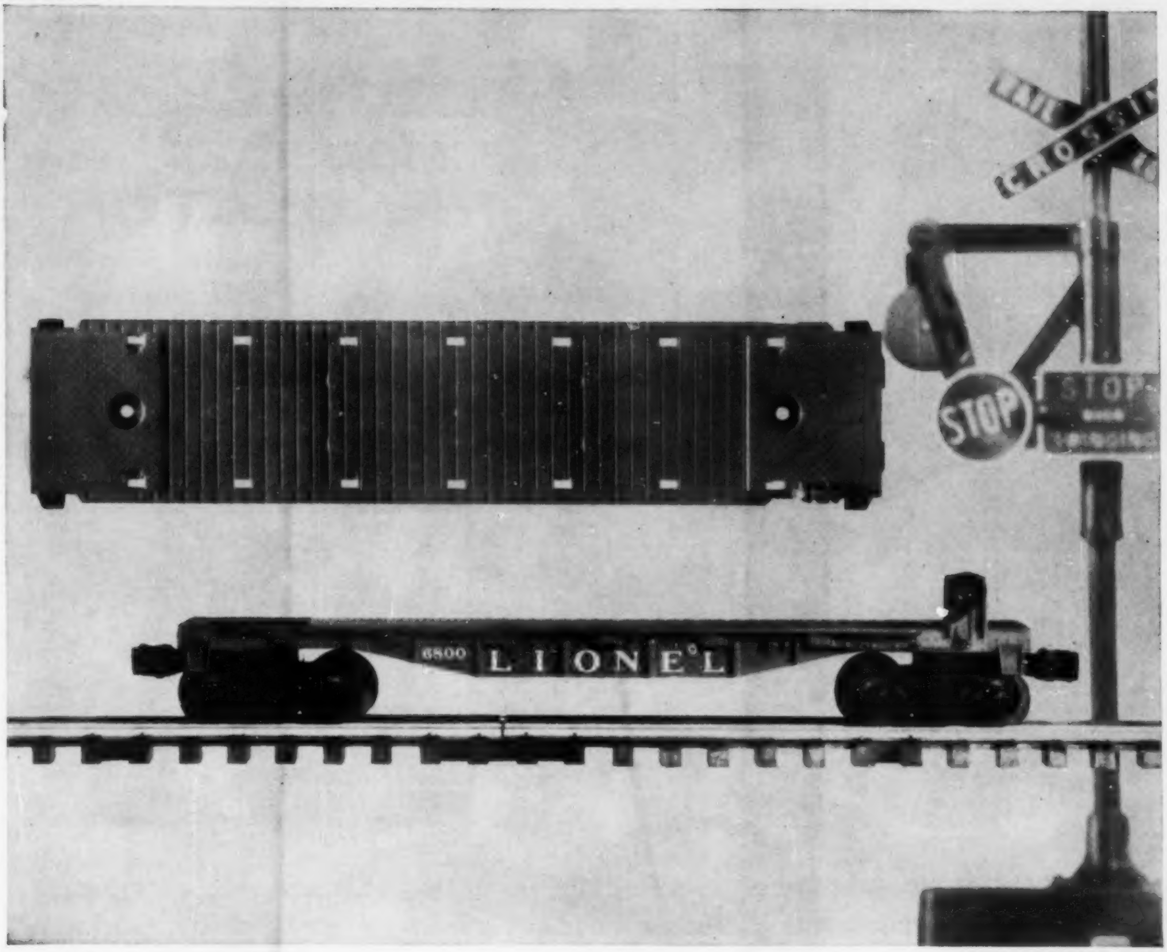
WORLD'S FINEST PLASTIC INJECTION MOLDING MACHINES

MOSLO

MACHINERY COMPANY

2442 Prospect Avenue
Cleveland 15, Ohio

In the above illustration are (left to right) Mr. Charles Stephens, Plant Superintendent, and Mr. William C. Holden, Vice President & General Manager of Engineered Nylon Products; observing their Moslo machine in operation.



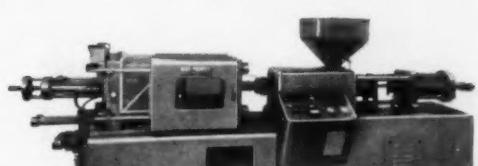
REED JETFLO cuts cycle time 50% on LIONEL flat car mold

This Lionel flat car, normally produced on a 8/10 oz. injection molding machine, was molded on a REED JETFLO '6' during a recent mold evaluation run. Result: the JETFLO cut the molding time in half with a proven increase in product quality.

The REED JETFLO, through more efficient, faster plasticizing and lower molding temperatures, provides the molder with these 3 important time and money saving advantages:

- faster molding
- higher, more uniform product quality
- dry coloring without premixing

Your shortest route to more profitable production is through the JETFLO's high-speed, low-cost molding. For complete details, call your REED Sales Engineer today.



ACTUAL MOLD TEST RESULTS COMPILED BY THE REED JETFLO '6'

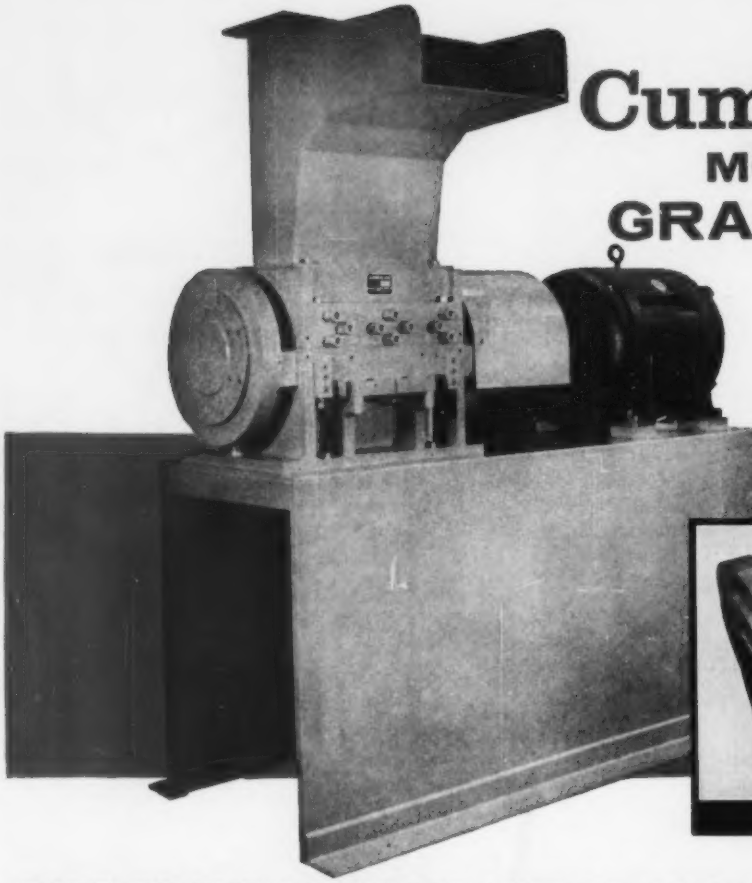
ITEM	MATERIAL	NO. CAVITIES	CONVENTIONAL MACHINE MOLDING CYCLE TIME	JETFLO MOLDING CYCLE TIME
Tail Lens	Crystal Acrylic	2	37 sec.	19 sec.
Eye Glass Frames	Butyrate (Hard Flow)	4	27 sec.	14 sec.

REED-PRENTICE

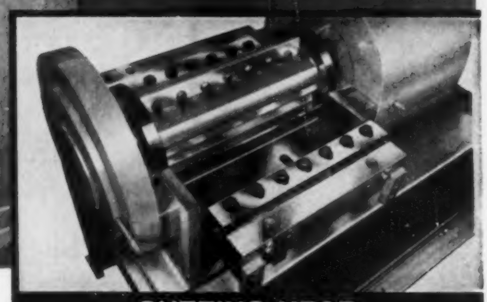
division of **PACKAGE MACHINERY COMPANY**

EAST LONGMEADOW, MASSACHUSETTS

BRANCH OFFICES: NEW YORK • CHICAGO • BUFFALO • DAYTON • DEARBORN • KANSAS CITY • LOS ANGELES



Cumberland
MODEL 20
GRANULATOR



CUTTING HEAD

PART OF THE COMPLETE LINE OF CUMBERLAND PELLETIZERS, BESIDE THE PRESS AND CENTRAL GRANULATING MACHINES, DICERS, CHOPPERS AND PRE-BREAKERS

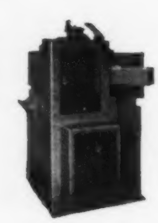
LARGE THROAT OPENINGS – 9" x 20"
– 12¾" x 20"

SUPERB CONSTRUCTION – heavy steel weldments with deep welds. Rotor and seal rings are heat treated to provide tough undamageable parts, and ground all over to achieve extreme dimensional accuracy and balance.

VERSATILITY – handles chunky parts of toughest plastic materials such as bleeder scrap, cylinder purgings and heavy slabs of thermoplastic materials. Special adaptors for handling long lengths of pipe such as kralastic, high impact vinyl and polyethylene.

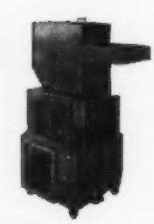
Watch future ads featuring other outstanding Cumberland machines and write for Bulletin **590**

STAIR STEP DICER



Perfect cubes or pellets 1/16" to 1". Two standard sizes accommodate up to 7" and up to 14" ribbons.

BESIDE THE PRESS GRANULATOR



Two new models. Throat sizes available:
8½" x 12"
12" x 16"
10" x 10"
6" x 10"
6½" x 8"

Cumberland
ENGINEERING COMPANY, INC.

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California Representative: West Coast Plastics Distributors, Inc.
8510 Warner Drive, Culver City, Calif.
FOREIGN LICENSEE — Burtonwood Engineering Company, Ltd., Burtonwood, Warrington, Lancashire, England—Sole Manufacturers and Distributors outside North and South America.

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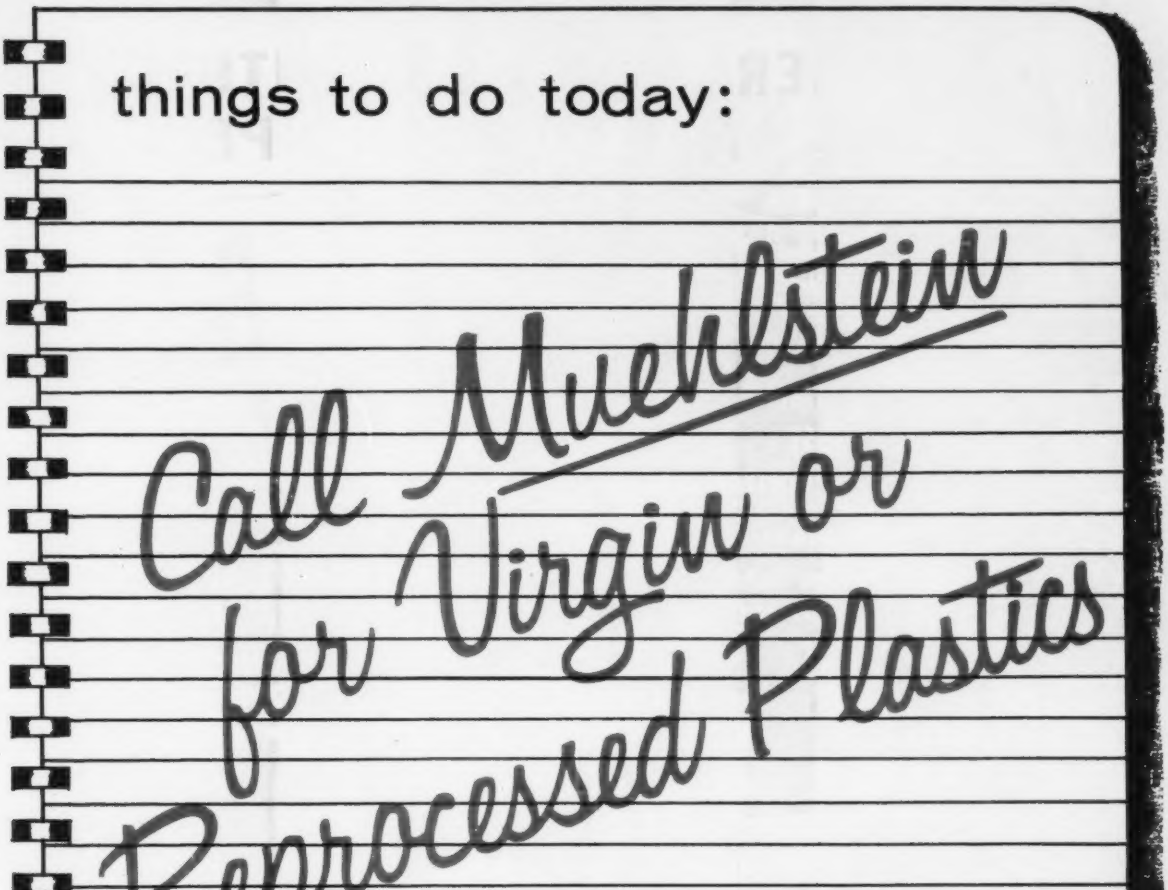
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Call Muehlstein for Virgin or Reprocessed Plastics
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In AKRON — HEmlock 4-3111
In BOSTON — HUbbard 2-8150
In CHICAGO — CLiffside 4-3939
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In TORONTO — EMpire 8-1395

DROPPED WITHOUT CRACKING. These 55-gallon drums were dropped from a fork lift. There's no sign of cracking or failure.

Molded by Federal Tool Corporation, Chicago
Drums manufactured by Redmanson Corp., York, Pa.

Never before possible...

extra-strong giant moldings

BAKELITE Brand Polyethylene DMD-7002

Gives Great Strength and Rigidity without Sacrifice of Appearance

This is the second in a series of notable polyethylene copolymer developments by Union Carbide Plastics Company. BAKELITE Brand High-Density Polyethylene DMD-7002 is an injection molding material with the rigidity and gloss needed for such applications as radio and TV cabinets, appliance housings, and packaging.

IT'S STRONG. DMD-7002 has twice the yield and tensile strengths of DPD-7365 , the earlier polyethylene copolymer in this outstanding series.

IT'S RIGID. This high-density polyethylene holds its shape even in large moldings—GIANT MOLDINGS—and it has THREE TIMES the impact strength of conventional high-density polyethylenes!

IT'S ATTRACTIVE. You can injection-mold DMD-7002 into articles with superior gloss and fine details. It offers an excellent combination of strength, colorability, and appearance characteristics.

Try it now—prove to yourself that DMD-7002 has all the advantages claimed for it. Ask your Union Carbide representative or write Dept. HC-51G, Union Carbide Plastics Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N.Y. *In Canada:* Union Carbide Canada Limited, Toronto 7.

TYPICAL PROPERTIES OF DMD-7002

Property	Value
Melt Index, g/10 min.	8.0
Density, g/cc at 23°C.	0.95
Secant Modulus, psi	100,000
Tensile Strength, psi	3200
% Utimate Elongation	24
Yield Strength, psi	3100
Room Temperature Impact	4.5 feet—No failure 5.0 feet—60% failure

UNION CARBIDE

BAKELITE and UNION CARBIDE are registered trademarks of Union Carbide Corporation.

With Coatings for Plastics...or for Vacuum Metallizing

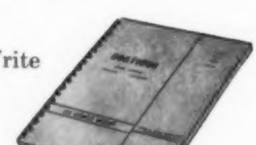
Bee shirtsleeve sales service makes money for you . . .

Like a peek over our shoulder at part of a report sent in recently by Bee representative Lee Dickinson?

"Took in samples of R222 (coating for plastics), spent the morning cutting clear into standard colors, mixing standard colors, and showing spray men proper techniques and methods of achieving the best mileage and coverage. Was able to achieve very satisfactory results . . ."

This is the kind of shirtsleeve service that makes Bee Chemical Company tick. It's the *kind* of knowledgeable service we'd like to receive if we were on your side of the desk. Bee men are ready to *show* you—any time—in your own plant.

Like to know more about us? Write for Bulletin E89.



Big things in coatings for plastics are coming from Bee. They make sense where it counts most—in your pocketbook. If you want the dollars-and-cents story, write now.

TRADE MARK

BEE CHEMICAL COMPANY

LOGO DIVISION

12933 S. Stony Island Ave., Chicago 33, Illinois
Phone: Mitchell 6-0400
On the West Coast: 17000 S. Western Ave., Gardena, California
Phone: DAvis 9-8343

"You and your clever ideas for 'easy, low-cost automation'! Just look at this bill for chopped mackeral"!

Friends, if there's one thing we can definitely promise you it's this: no "fishy" promises on production schedules or delivery dates.

We base our promises on the requirements of the parts to be custom molded, the work load at the time of the order, and our long experience in handling similar orders. As a result, when we quote, we give dates that are not only competitive, *they are the actual dates we will meet.*

But why not get the full story? Just take your phone off your *hook* and ask for one of our nearby offices. Or drop us a *line*. We guarantee that what we'll tell you won't be a bit hard to *swallow*.

BOONTON MOLDING CO.

BOONTON, NEW JERSEY

New York Metropolitan Area—Cortlandt 7-0003
Western New York Area—Alden 7134
Connecticut Area—Woodbine 1-2109 (Tuckahoe, N. Y.)
Philadelphia Area—Pioneer 3-0315

NEW DESIGNS IN MARLEX

New lightweight boat is thermoformed from unbreakable, floating MARLEX*

This unusual new sailboat is engineered and marketed by Technical Plastics Co., Culver City, California. Because they are made of MARLEX, these boats are tough, corrosion-proof, lightweight, rigid and unbreakable. Even when loaded with as much as 140 lb., there is plenty of freeboard. Technical Plastics promotes them for use on pools, lakes and bays.

This boat, which is 5' long and 28" wide, weighs 8 lb. and is one of the largest products ever thermoformed from MARLEX rigid polyethylene. Jewel City Products Co., Los Angeles, Calif., is thermoforming these boats from 156-mil MARLEX blanks, measuring 34½" x 65¼", furnished by Kal Western Plastics, Inc., Pico-Rivera, Calif.

If you use or specify thermoplastics, you should know more about MARLEX. No other type of material serves so well and so economically in so many different applications. How can MARLEX serve you?

*MARLEX is a trademark for Phillips family of olefin polymers.

PHILLIPS CHEMICAL COMPANY, Bartlesville, Oklahoma

A subsidiary of Phillips Petroleum Company

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NEW ENGLAND	NEW YORK	AKRON	CHICAGO	WESTERN	SOUTHERN	EXPORT
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MARLEX

because Thermatron:
- guarantees distortion free surfaces
- eliminates costly rejects
- has advanced features that prevent equipment obsolescence
- operates with higher frequency permitting successful diversification.

SOCIETY OF THE PLASTICS INDUSTRY · SPI

THERMATRON

ELECTRONICS DIVISION OF WILLCOX & GIBBS 1859-1959

WILLCOX & GIBBS SEWING MACHINE COMPANY • 214 West 39th Street, New York 18, N.Y.

SALES & SERVICE OFFICES AT: ATLANTA • BOSTON • CHICAGO • DETROIT • LOS ANGELES • NEW YORK • PHILADELPHIA • ST. LOUIS

THERMATRON—is the only manufacturer of Electronic Welding Equipment with National sales, service and project engineering.

THE PLASTISCOPE*

News and interpretations of the news — By R. L. Van Boskirk

Section 1 — **August 1959**

High density PE at Housewares Show. High density polyethylene invaded the Housewares Show in Atlantic City, N. J. in impressive fashion. It hasn't pushed out conventional PE by any means—and poundage is still modest—but it is rapidly becoming an important factor in housewares molding. Some of the largest molders are still approaching a large scale changeover to high density in a most cautious manner—long-time contracts for purchase of conventional PE and changes in molding technique are claimed to be their reasons for holding back. But other molders have gone for it like bears after honey. The principal items involved are bowls, pitcher and tumbler sets, and large pieces, such as step-on garbage cans, dish pans, wastebaskets, and especially vegetable bins. There is also a large amount of blended high and low density material involved that is often used at a density of about 0.940.

Various molders still fuss about changing over from low to high density PE, but they also fussed about changing over from polystyrene to PE a few years ago. Years ago they fussed about changing from acetate to polystyrene. But inevitably the change came when certain molders adopted the newer material, and others had to follow to keep up with competition. In a few year's time, high density PE may equal or exceed all other plastics in volume use at the Housewares Show.

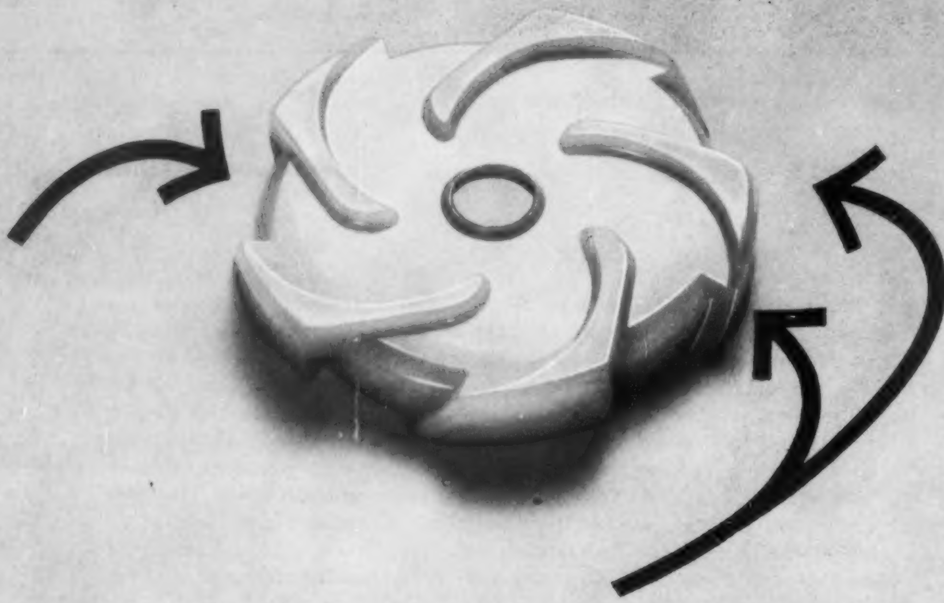
How much volume is involved? The poundage of high density PE used in housewares is debatable. In 1958 some 75 or 80 million lb. of all types of PE were used for housewares. In 1959 there will probably be close to 100 million involved. Suppliers hope that 40 million may be high density.

But competition from other materials has already entered the field. Union Carbide's new copolymer medium density (0.935) PE, which gives rigidity, low temperature, flexibility, easy flow and gloss, was evident in surprisingly large volume in large pieces, such as garbage containers and wastebaskets. Another competitor is polypropylene, as mentioned in the paragraph below.

Polypropylene in housewares. Several new items in polypropylene attracted considerable attention. A 16-piece set of dinnerware that retails for $5.95 and will take all kinds of abuse in a dishwasher was one. A Platter Porter, which is a carrying-filing case for 45-rpm records that employs the built-in hinge and snap, was another. Perhaps the most sensational was a line of stacking shelves —3 shelves—that can be used for books, dishes, etc. They weighed 4 pounds. Another molder had a strainer which is used for pouring water off hot cooked food—said it was "so easy" to mold and would take the heat without distortion.

A Chicago molder had a line of tumblers, bowls, and crispers with bottom portion that could be used as a dishpan. He (To page 37)

*Reg. U. S. Pat. Off.



Chicago Molded plastic licks corrosion problem...cuts cost, too

This molded plastic part is an important component of a deep-well pump. For years it was made of brass and subject to the abrasive and corrosive effects of impure waters. How could it be improved? Would a plastic resist this wear and absorb little or no water? That's when the manufacturer came to Chicago Molded. Our answer—to injection mold it in linear polyethylene. Cost—only a small fraction that of brass, with finishing eliminated. We had an idea, too, that the smooth surface of the part would improve the efficiency of the pump. It worked just that way, and it's good business at several thousand parts a year. We're equally experienced at compression and transfer molding . . . practically every known plastic. Because of this we can make unbiased recommendations . . . provide the material and method that will assure utmost value to you. Perhaps custom molded plastics can solve your problem. Want to discuss it? Call or write . . . no obligation.

CHICAGO MOLDED
PRODUCTS CORPORATION
1046 North Kolmar Avenue, Chicago 51, Illinois

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was extremely enthusiastic in his praise for the new material because of its finish and "easy" molding. Especial emphasis was given to the built-in hinge that seems particularly adaptable to PP because of toughness and flexibility —lids for coffee pots are the first example. Some molders are using it for a hinge on large items, such as garbage can lids.

New company to make polymers. Western Petrochemical Corp., 2 West 45th St., New York, N. Y., is a new company organized to discover and develop new polymers. The president is Maurycy Bloch, formerly general manager of Warwick Wax, once a division of Sun Chemical, but now separated from that company to form the basis of Western. One of the directors and company consultant is Dr. Herman Mark, well known polymer chemist. Dr. Norman G. Gaylord, formerly assistant director of organic chemistry at Interchemical, will head up the polymer division of Western.

One purpose of the company is to upgrade waxes by adopting polymer technology. Waxes are low molecular weight polymers which can be reacted with other materials to form block or graft polymers. Dr. Gaylord will direct activities toward improving wax properties but also find more use for them with plastics. During this development work there will be an effort to create new and distinct polymers not necessarily based on waxes. It is expected that early attention will be directed to emulsion polymers and discovery of improved plastic coating resins.

An interesting sidelight on this venture is the indication that the wax industry isn't going to submit easily to invasion of its field by polyethylene and other plastics. It's not only going to fight the possible loss of wax coated milk containers, but may also bring in a new line of plastics to compete in other areas.

New producer of polystyrene. A new entrant into the plastics field from whom much more will be heard in the future is Amoco Chemicals Corp. of Chicago, which has announced plans to build a large scale polystyrene polymer plant in Joliet, Ill. that will be completed by the third quarter of 1961. Product development facilities are expected to be in operation by the second quarter of 1960, and will produce a variety of high impact and general purpose polystyrene for customer evaluation by the second quarter of 1960.

The plant operation will be based on a process for the manufacture of polystyrene developed by the research laboratories of Standard Oil Co. (Indiana) and is supposedly a low cost operation. Amoco is an off-shoot of Standard and has already built a plant to produce phthalic anhydride, isophthalic acid and terephthalic, the latter of which is used for production of polyester resins similar to those used in Mylar and Dacron. Standard has also done extensive research in polyolefins, and is involved in the patent scramble that envelops the polypropylene situation. It is assumed that Amoco will eventually carry the ball in this operation and sooner or later become a producer of polyolefins.

Amoco's venture into polystyrene marks the advent of an eighth major polymer producer in addition to several low volume producers and several copolymer plants. In March the industry produced molding (**To page 39**)

HAS REAL "BLOTTER-ACTION" IN PLASTICIZER ABSORPTION...

In coated fabrics, extruded and molded products requiring high concentrations of plasticizer, the "blotter-action" of Vygen 161 gives outstanding results. Its ability to absorb much more plasticizer than ordinary resins makes it an ideal blending resin with which to obtain dry preblends containing as much as 60-100 parts of plasticizer.

In addition to its high plasticizer "take-up", Vygen 161 also provides excellent heat stability.

With Vygen 161, heated pre-blenders are not required. Blending cycles are shorter, and the dry pre-mix offers faster fluxing on either open mills or in Banburys.

Color masterbatches are another application for which you should consider this excellent "blotter" resin. Write us today.

TYPICAL ANALYSIS

Form	White Powder
Intrinsic Viscosity	1.03
Specific Gravity	1.40
Bulk Density, gm/cc	0.32
lbs/ft^3	20.0
Volatiles	0.2
DOP Absorption gr/100 gr resin @ room temperature	225

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THE PLASTISCOPE

(*Continued from page 37*)

material, including copolymers, at an annual rate of 670 million pounds. First four months production in 1959 was 196 million lb., compared to 127 million in 1958. Nobody seems able to explain where this big growth has come from—"it's clear across the board" say producers—but it is obvious that much of it is impact types. Total production and sales in 1958 was around 450 million and there is scarcely a soul who will predict more than an optimistic 600 million lb. sales figure in 1959, despite the tremendous first four month's consumption. Amoco is stepping into one of the most unpredictable fields of all plastics, but one thing is certain—those who predicted polystyrene would start leveling off a year or so ago have had a long "wait and see" period.

Another producer of polycarbonates. Mobay Chemical plans to manufacture polycarbonate resins in a new plant at New Martinsville, W. Va. that is to be completed in early 1960. Farbenfabriken-Bayer, which with Monsanto owns Mobay, has been manufacturing polycarbonates on a commercial scale in Germany for nearly a year, and a Mobay team is studying technology and applications there now. It is expected that Bayer's know-how will thus be used to help Mobay get into production rapidly. The material will be marketed under the tradename Merlon.

Effect of steel strike. As this item goes to press the steel strike has had little effect on raw material supply for plastics. Benzene, derived from coking in the steel plants and used for production of styrene, phenol, nylon, and maleic, is the chief material involved. It is presumed that users began anticipating this possibility as long ago as last February and built up their stocks to take care of a possible shortage that could be caused by shutting down the steel plants. There could be some pinches if the strike lasts more than six weeks, and real shortages if it goes over two months, except that all business would probably slow down with a resultant drop in demand for plastics and other products.

When the strike is in force, production of benzene drops from around 30 to about 18 million gal. a month, so that a user may still get half his usual amount and thus stretch out his present inventory. This 18 million is made up of about 3 million from coke ovens still operating, tar distillers, petroleum, and imports. Gulf Oil has just announced a new 30 million gal.-a-year benzene plant to add to this capacity. Benzene from Russia has been reported available at less than 25¢, compared to 31¢ domestic benzene, but aside from the large amount contracted for by Dow, very little is known to have been purchased. The Russians generally ask that something be purchased from them in return, and U. S. customers are not interested.

Phthalic for plasticizers and reinforced plastics. Napthalene, from which phthalic anhydride is produced, is, likewise, affected by the current steel strike, but the supply is thought to be sufficient to last through September, even though phthalic plants are now running full blast and there has been little chance for building up inventories except perhaps in finished goods. Demand for phthalate in plasticizers and polyesters has remained strong through July, but customers are not as anxious as they were (**To page 41**)

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in early summer. Perhaps the best sign that supply is keeping up with demand is that there is no apparent indication of black marketing in phthalic.

Maleic anhydride situation. Maleic, which has been in the news for some time because of a temporary tightness, could be affected by a shortage of benzene from coking plants. However, it would only require around 10 million gal. to make the 60 million lb. of maleic which is expected to be consumed in 1959.

The tightness in maleic is believed to have arisen from the extra heavy demand for polyester laminating resins used in boats since maleic is an ingredient in the polyesters. But this business was expected to slacken in the summer and fall when boat building normally falls off. In 1958 consumption of maleic was estimated at around 54 million lb. or 80% of capacity and according to one analyst was divided as follows: Polyesters, 23 million lb.; alkyds, 14 million; agricultural uses, 6 million; rosin sizing, 3½ million; miscellaneous applications, 8 million.

Maleic expansion. The temporary tightness in maleic has been followed by a flock of expansion announcements even though there is no guarantee that the recent scarcity is any more than a passing incident. Present capacity of companies producing maleic from benzene—Allied, Monsanto, and Reichhold—is thought to be around 60 million lb., and there is a small amount that could be derived as a by-product from phthalic production. American Cyanamid will bring in its new 14-million-lb. plant this fall and increase to 20 million in 1960. Reichhold has announced an expansion of from about 5 now to 20 million later. Allied's National Aniline Div., which claims to be the largest producer, will increase by an unannounced amount late this year. Heyden Newport plans to build a 24-million-lb. plant at Fords, N. J. When all this new capacity comes in (a good portion for captive use), there is likely to be enough maleic around to produce headaches and salesman's colic for several years to come, unless the polyester resin business grows even faster than its most imaginative boosters have ever forecast.

Rexall buys Imco. Another peg was driven into the Rexall Drug & Chemical Co.'s growing plastics kingdom with the recent acquisition of the Injection Molding Co. of Kansas City. Imco is a pioneer polyethylene bottle producer that started business 13 years ago with three extrusion machines and still holds patents on the process of heat embossing product names and information on plastic containers.

According to the *Kansas City Star*, 187,500 shares of Rexall stock were to be exchanged for the outstanding 500,000 shares of Imco. With Rexall stock selling at $50 a share, the transaction amounts to almost $9½ million. The company employs 600 persons—250 in Kansas City and the others in plants at Excelsior Springs, Mo., Belvidere, N. J., Harrisonburg, Va., and Cooksville, Ontario, Canada. William Archer, president of Imco, will continue as active head of the firm.

For additional and more detailed news see Section 2, starting on p. 204

LETTERS TO MODERN PLASTICS

Where readers may voice their opinions on any phase of the plastics industries. The editors take no responsibility for opinions expressed.

"Boss of the Year"

I thought you might be interested to know that a plastics manufacturer is in the running for the international title of "Boss of the Year."

In April, the Nashville, Tenn. Chapter of the National Secretaries Assn. named as Nashville's "Boss of the Year" William R. McLain, President of Kusan, Inc., manufacturers of plastic toys, trains, and industrial products for the past 13 years. Now Mr. McLain is eligible for the international title, and I'll bet he'll make

it. We are shown together in the photograph.

I'm particularly happy to report this to you since he's my boss. . . . I've been with Kusan since September, 1952 . . . and I nominated him. Why? Primarily because he possesses intelligence, creativeness, foresightedness, humbleness, and leadership. He is a person of understanding and a man of the highest character. I have never known him to be unfair to anyone. He will go over half way to give the customer the best for his money, and to give his employees the best equipment to work with at the best salary possible.

I'm sending you this letter because it occurs to me that your publication might like to be advised of this recognition.

Mrs. Robert L. Howell
Secy. to Mr. McLain

Kusan, Inc.
Nashville, Tenn.

Easier said than done

We have been concerned about the difficulties involved in interpreting Underwriters Laboratories' recent proposal regarding the use of plastics in room air conditioners. Some of these difficulties may have arisen because of a failure on the part of the plastics industry to tell the full story of our efforts to develop suitable "flameproof" materials that can do all the jobs present thermoplastics are doing in appliances. Apparently there has been some lack of awareness of the severe barriers in terms of fabrication problems and reduction of impact strengths or other properties which are lost in the process of "flameproofing."

We feel that it is of the utmost importance that the public, the appliance industry, and Underwriters Laboratories be fully aware of the magnitude of the task asked of the plastics industry: i.e., to produce a flameproof material which is at the same time as practical and economical as the materials now being used. It is equally important that all elements of industry and the public be fully aware that we are acting, not against safety, but in the public interest in the broadest sense. Our efforts in accomplishing this will continue to be of critical importance as they have been in the past.

It may be that the time is appropriate for a summary article reviewing the work done to date by the plastics industry toward development of flameproof materials which are economical and can be widely used. If MODERN PLASTICS, as a major spokesman for the industry, is interested in such a project, we will cooperate in all possible ways to develop this story.

R. N. Hampton,
Appliance Market Coordinator,
Molding Materials Sales,
Plastics Department

The Dow Chemical Co.
Midland, Mich.

MODERN PLASTICS *is indeed. We are readying such an article on the increasingly important subject of flame resistance in plastics for our Sept. issue.—Ed.*

To complete the record

We were delighted to find that the Redmanson drums were included in your article ("Why the fast-growing market for big PE containers," MPl, June 1958, p. 85). We have already had several inquiries from potential customers for the drums and appreciate the publicity very much. Prices of these containers are substantially less than "one-third that of stainless steel drums," however.

We regret having been unable to send you a photograph of our 55-gal. drum in time to have it included in your article, which showed the pictures of many of the drums and containers produced by other fine companies in this field. Your readers may have an interest in seeing a picture of this large container and we, therefore, enclose a glossy print of a 10-year-old girl holding the 55-gal. drum and cover. This drum is without doubt the largest container

ever made by conventional injection molding technique and so far as we can determine, is either the largest or one of the largest products of any kind ever produced in plastics by injection molding.

L. Earl Hoffman,
Vice-President, Sales

Redmanson Corporation
York, Pa.

We read with great interest your article on big polyethylene containers. It was a very complete article, the only thing missing was the name of our company; we have been making tanks up to 100 gal. by the heat welding fabrication method for many, many years.

K. Landsberger,
President

Bel-Art Products
Pequannock, N. J.

FAST

WETTING

CURING

STRENGTH DEVELOPMENT

MEANS MORE BOATS PER DAY

This is precisely why more leading manufacturers of plastic boats are turning to IC* POLYESTER RESINS AND GEL COATS.

If you're missing part of the boat-buying boom because of limited capacity, let us show you how to increase production with your present equipment.

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Commercial Resins Department—1754 Dana Ave., Cincinnati 7, Ohio, 224 McWhorter St., Newark 5, N.J. Factories: Chicago, Ill. • Elizabeth, N.J. • Cincinnati, Ohio • Los Angeles, Cal. • Newark, N.J. • Mexico City, Mex. In Canada, these polyester resins are made by Chemical Oil & Resin Company, Toronto, Ontario, and sold under its trademarks. **IC is a trademark of Interchemical Corporation.*

Photograph courtesy of CRESTLINER INC., Little Falls, Minn.

NEW MACHINERY-EQUIPMENT

Specifications, claims made, and prices appearing in these pages are those of the manufacturers or sellers of the machinery and equipment described, or their agents.*

Unwind and rewind stands

Down-time during roll and core changing is eliminated with the Stanford turret-type unwind and rewind stands, thus speeding web-fed printing and converting operations on plastic films.

In the TO-24 unwind unit, called the "Flying Splice," two rolls of stock are mounted on tandem shafts in a rotatable turret. When the first roll is exhausted, the turret rotates, and the second roll can be instantaneously spliced onto the moving web without a break in the process.

The TO-24R rewind unit, which Stanford calls the "Flying Knife," has a turret equipped with dual windup shafts. When the desired cut-off point is reached, the knife action of the turret instantly attaches the moving web to the fresh core.

Both machines handle 18- to 72-in. O.D. rolls and operate at speeds of 1000 ft./min. They are adjustable to any web width, have automatic cut-off knives, power-driven turnover, and air chuck. Constant tension brakes and an automatic web guide are optional features. *Stanford Engineering Co., Salem, Ill.*

Injection molding machine

The Natco 800 injection molding machine offers a patented closed circuit hydraulic system, which is said to eliminate the possibility of hydraulic shock. This allows the mounting of electrical cabinet, water lines, and power units on the machine, thus allowing clutter-free traffic areas all around the machine.

The 100,000-lb. machine is powered by two motors having a total capacity of 82½ hp., and is equipped with interchangeable injection plungers and feed bushings for either 20,000 or 30,000 p.s.i. It will single-plunger feed 80 oz. of GP polystyrene or 50 oz. of low-density polyethylene. Plasticating capacity in GP polystyrene is 350 lb./hr. The clamp has a maximum 40-in. stroke, and a full 850 tons of clamping pressure. Its 55- by 55-in. platen accommodates molds up to 55 by 36¼ inches.

Also available is a Model 800X, with 55 in. of clamping stroke for molding deep parts and a high speed injection unit which doubles injection rate from 2000 to 4000 cu. in./minute. This model weighs 110,000 lb. and has a power capacity of 157½ hp. *National Automatic Tool Co., Inc., Richmond, Ind.*

Web printer

A color printing machine for PE film is intended for use in line with an extruder or independently with roll stock. It will print by flexographic, gravure, or valley processes, and can be converted to do laminating and embossing. Web widths up to 90 in. can be handled, with up to 84 in. of printed width. Drying of ink is hastened by 12 full-width radiant heaters. Printing speed is set at desired level by means of a U. S. Varidrive system that has three independent, variable-speed units. A constant-tension, turret rewind is included. Printing speed (gravure) is about 160 ft./min. with one color on 1.25-mil PE film. With two colors the rate is about 125 ft./min. *Faeco Machine Co., Inc., 643 21st Ave., Paterson, N. J.*

Small injection machine

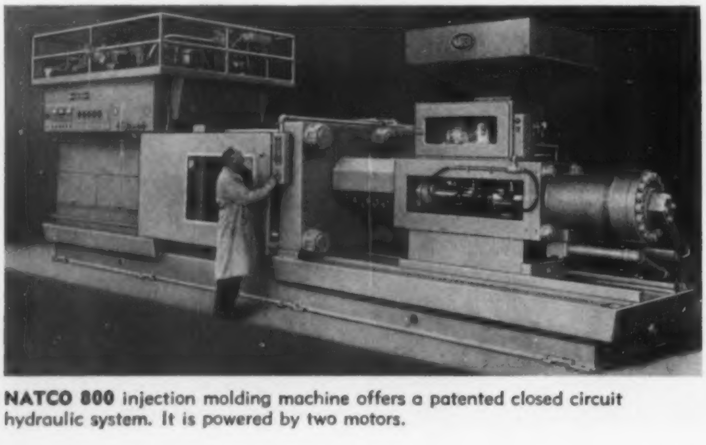
The JS models of Formaton fully automatic injection machines differ from their predecessors, the J models, chiefly in that single-stroke injection is used—multi-stroke prepacking has been eliminated. Two basic models are offered with a choice of plungers, power components, and attachments. Design of "spiral spreader heating cylinder" permits molding at greatly reduced pressures: top pressure necessary is 11,000 p.s.i. Cantilever clamp design provides for operation in batteries over a single conveyor belt. Clamp stroke is adjustable between 2 and 10 in. with a 5-in.-thick mold. The JS37 1.5-oz. machine is available with either a 5- or 7.5-hp. drive. The JS-66 2-ouncer has a 7.5-hp. drive. Prices of $4500 to $6400 include many standard features. A recommended extra is a supercharger in hydraulic pump-suction line to cut down noise and raise speed by 15%. *Guy P. Harvey & Son Corp., Leominister, Mass.*

Bench-model heat sealer

The Comet 54 UL bench-type sealer heat-seals by conduction virtually every kind of unsupported thermoplastic including Mylar coated with PE. can also seal most coated and laminated films. Foot-operated, the Comet has an electro-mechanical timing lock adjustable from 0.25 to 15 sec., a glass-reinforced platen coated with TFE resin, full feed-through for special bag lengths. Power consumption is 600 watts. The low-wattage cartridge heaters are designed for long life, and input power can be adjusted to yield platen temperatures up to 450° F. Jaw length is 14 inches. *Product Packaging Engineering, 5713 Joanne Pl., Culver City, Calif.*

Laminator-die cutter

With one control the Mark IV laminator handles all-plastics or paper-insert laminates (To page 46)

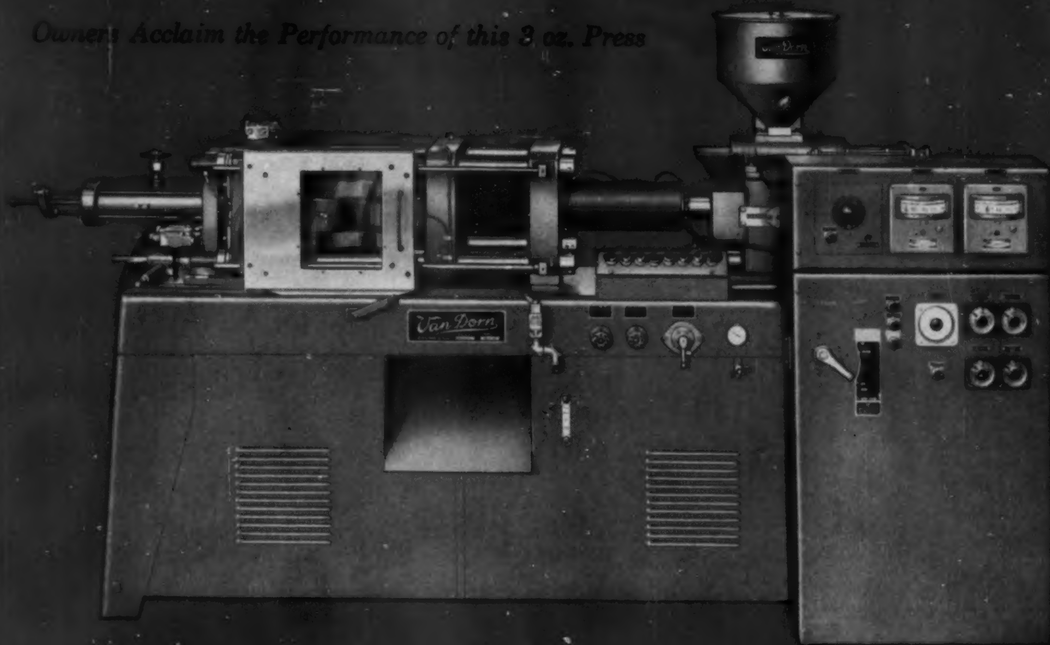


NATCO 800 injection molding machine offers a patented closed circuit hydraulic system. It is powered by two motors.

* Prices are deemed to be F.O.B. sellers' plants (unless otherwise stated), are for "standard" models, and are subject to change without notice. The publishers and editors of MODERN PLASTICS do not warrant and do not assume any responsibility whatsoever for the correctness of the same, or otherwise.

Because Model H-400 has proved so efficient . . . Customers have demanded a companion Van Dorn 3 oz. Plastic Press

Owners Acclaim the Performance of this 3 oz. Press



FEATURES OF

VAN DORN

H-300 INJECTION PRESS

HIGH PLASTICIZING CAPACITY up to 65 pounds plus per hour

HIGH CLAMPING PRESSURE—75 tons

HIGH SPEED OPERATION up to 1200 dry cycles per hour

FAST MOLD SET UP—toggle assembly easily adjusted for mold thickness

ADJUSTABLE TOGGLE STROKE 4" to 8" Standard and 4" to 12" optional

LARGE PLATENS accommodate molds up to 9⅜" x 16"

FOUR TIE BARS

HYDRAULIC CYLINDER positions heater and injection mechanism for fast and convenient set up and purging

MAXIMUM OPERATOR PROTECTION with hydraulic and electrical interlock

SELECTIVE CONTROL to change from automatic to semi-automatic to hand operation

INJECTION PLUNGER & TOGGLE Speed adjustable

HYDRAULIC VALVES mounted on manifold for accessibility

ONE SHOT LUBRICATION—Standard equipment

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(From page 44)

without attention or adjustments. Laminations are completed singly or in groups of four or more within the platen size limits of 4½ by 5½ inches. Up to 60 wallet-size cards or 120 badges can be laminated per hour. The unit is self-contained and re-

CARVER Mark IV laminator can handle all-plastics or paper-insert laminates without attention or adjustments.

quires only a normal a.c. electric outlet. Thermostatic control provides for adjustable cycle to accommodate varying sizes, materials, or other conditions. $625.

The Mark IV die cutter for trimming cards or pass laminations is hydraulically operated and electrically controlled. A receptacle at the rear of the laminator permits both units to be used together on the same desk, if desired. The cutting assembly permits visual aligning of cards. The action of the cutting die pops the card to the top for easy removal. Machine will trim well over 100 cards per hour. Die size for the standard model (for identification and credit cards) is 3½ by 2⁵⁄₁₆ in. with ¼-in. radius corners. $325. *Fred S. Carver, Inc., Summit, N. J.*

Gage for wire coating

A portable eccentricity gage enables unskilled help to make instantaneous measurements of the eccentricity and/or thickness of insulation on coated wires. Measurements are made without interrupting the process, and one instrument can be used to check the operation of a number of extrusion heads. Suitably modified, it can also be used to measure the wall thickness of extruded plastic tubing and to monitor such thicknesses. Developed in Switzerland, the instrument is marketed in the U. S. by *InterSales Co., P.O. Box 621, New Canaan, Conn.*

Nuclear thickness gage

The Model 42000 nuclear thickness gage is capable of measuring material thicknesses to within two-millionths of an inch on such products as film, coatings, resin impregnations, foils. The gage is fully compensated for temperature changes, has a continuously variable response time from ¼ to 30 sec., can be used in pairs with a single electronic control unit to detect thickness or density at two points. This makes it easy to measure a difference in thickness or density between two points in an operation. For example, the gage can register the areal density of an applied impregnation on a cloth or paper by detecting density before and after impregnation. *Radiation Counter Laboratories, Inc., Nucleonic Park, Skokie, Ill.*

Versatile plastic shear

The Draco plastic shear cuts and trims plastic sheet and laminates, fibre board, veneers, and other hard, brittle materials. Straight, curved, or circular patterns may be cleanly cut without edge cracks or chips, it is claimed.

Developed by German engineers, the shear weighs only 1 lb. and attaches easily to any ¼-in. electric drill. Cutting edges are of special alloy steel and are designed to give 500 hr. of service before resharpening. An attached guide assures accurate trimming. Cutting speed is approximately 11 ft./min., even with materials up to ³⁄₁₆-in. thickness. The shear is fully guaranteed and retails for $38.25. *Draco Div., L. E. Birbach Associates, Inc., 1130 Main St., Malden 48, Mass.*

Die cutter

The Model D2212 die cutter was developed specifically for cutting rigid plastics from continuous rolls or from continuous lengths of a thermoformed web. It can die-cut and eject at up to 20 strokes per minute. Feed index may be adjusted precisely from 6 to 12 in., will accommodate webs up to 22 in. in width. Steel rule and other dies can be used with the machine, which is equipped with a heat-assist device that gives a clean cut edge and greater die-cutting length than could be obtained with cold cutting. It also permits cutting of materials that craze when cut cold. Air pressure required is 100 p.s.i. *Trono-matic Machine Mfg. Corp., 1881 Park Ave., New York 35, N.Y.*

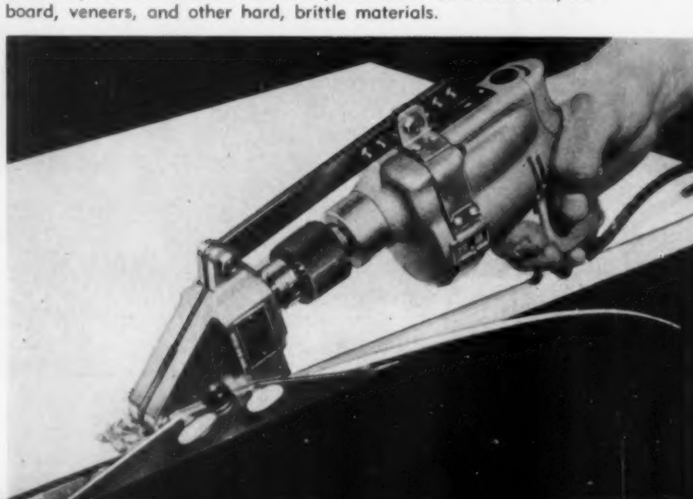
Roll former

The Chromalox roll former wi[illegible]ke ¾-in. inside and outside radius bends in postformable, decorative plastic sheets. The unit consists of an aluminum bending anvil with electrical heating element, thermostat, removable chromium-plated follower roll, and 325° F. Tempil pellets for adjusting the thermostat. Type PFR-10-A is available for bends up to 10 ft. long and Type PFR-12-A for bends up to 12 ft. long. *Edwin L. Wiegand Co., 7500 Thomas Blvd., Pittsburgh 8, Pa.*

Injection molder

The Model 275TA-8/10-oz. injection machine features larger platens and improved safety features as compared with its predecessor, the 275T (described in MPL, June 1956, p. 282). Platens are 27 by 27.2 in. with 15.5 in. **(To page 48)**

DRACO plastic shear cuts and trims plastic sheet and laminates, fibre board, veneers, and other hard, brittle materials.



NEW MACHINERY-EQUIPMENT

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between tie bars both vertically and horizontally. Mold clamping stroke is adjustable from 6.2 to 11.5 inches. The new safety circuits include double limit switches and a hydraulic lock for the door so interlocked that if any part of the circuit fails the machine opens and stops. Locking force is 275 tons, plasticating capacity is 120 lb./hr. of polystyrene and dry-cycle time is 8 seconds. The standard injection rate of 13.3 cu. in./sec. can be doubled by adding an optional prefill arrangement. Hydraulic system is powered by 25-hp. motor. *Reed-Prentice Div., Package Machinery Co., East Longmeadow, Mass.*

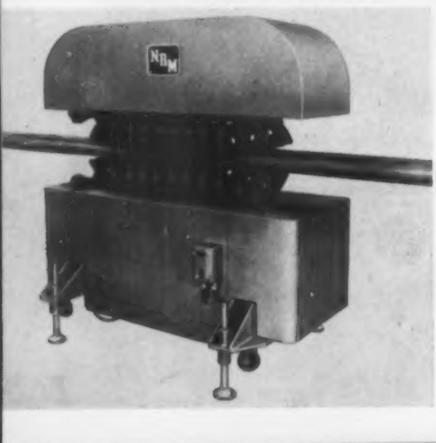
Portable inker for hand roller coating

A small portable machine for uniformly coating hand transfer rollers which in turn transfer the color to the coated surface is air-operated, requiring only 6 c.f.m. of air. A speed reducer permits accurate control of the pick-up and distributing rollers in order to accommodate various coating materials. Roller diameters—two different-sized rollers can be used—are chosen so that the length to be printed is covered with just one turn of the roller. Roller pressures are easily adjustable, rollers easily demounted. *Conforming Matrix Corp., 364 Toledo Factories Bldg., Toledo 2, Ohio.*

Haul-off for extruded pipe

A portable haul-off for extruded plastic pipe handles diameters up to 8 in. without distorting the pipe. It is reportedly capable of a 5000-lb. pull at a speed of 5 in./min. The pipe is pulled uniformly by multiple, rubber gripper-shoes having a 26-in. linear grip. These gripper-shoes can be changed for different pipe sizes in about an hour. The haul-off is rolled into position on the extrusion line by track-type casters; adjustable jacks lock it, and provide for raising or lowering to operating level. *Extruder Div., Nationl Rubber Machinery Co., 47 W. Exchange St., Akron 8, Ohio.*

NRM portable haul-off for extruded plastic pipe handles diameters up to 8 inches.



Printer for objects with flats

A one-color box printer can be used to print flat objects made of plastics, rubber, wood, and metals, using either the flexographic system or roller coating. The printable area ranges for 1 in. square to 5 by 7 inches. The object thickness should be between 0.5 to 2.25 inches. Up to 10,000 pieces per hour can be printed. A drier and after-cooler are furnished as standard equipment. The ink-fountain shafts are self agitating and are fitted with force-back seals that prevent shaft "wicking." Printing assembly is center-locked with micro adjustments; all cylinders can be removed with one screw. The press is expected to be useful as a laboratory press or as a production press for molded (and formed) plastics parts. *Jack R. Levien. P. O. Box 5353, Richmond, Va.*

Embossing machine

The Union embossing machine preheats and softens plastic material, then applies an embossed pattern to the softened surface, all in a single operation. It can also be used to emboss leather or tiling.

The embossing roll has a chrome-plated machined finish. The back-up roll is neoprene rubber, and is air-actuated to apply 5 tons of pressure to the embossing roll. Individual stops on the bottom roll control nip between the rolls.

Heat is provided by a series of infra-red calrod heating units located on the infeed side; intensity of heat is regulated by a proportional timer. The standard unit is a 14-in. face roll type, with rolls 9 in. in diameter. *Union Tool Corp., Warsaw, Ind.*

Heat sealing machines

Interchangeability of sealing chucks, permitting sealing of various shapes and sizes of hollow, injection molded parts, is featured in a full line of three Cosomatic heat sealing machines. Special segment-type chucks can also be supplied for the sealing of irregularly-shaped units.

COSOM vertical sealer is designed for unequally-sized, long, or obtuse shapes.

Largest of the line is the vertical sealer for unequally-sized, long, or obtuse shapes. For high production, a high-speed rotary sealer is offered. Third in the line is an improved version of the original Cosomatic horizontal heat sealer.

The manufacturer claims a permanence of seal approaching that of arc welding processes. By producing a completely fused, leak-proof seal, the Cosomatic machines eliminate the use of adhesives or solvents. Success has reportedly been gained with the sealing of nylon sections.

For easy installation, standard 220-v. drive motors and heating currents are specified. *Cosom Engineering Corp., 6012 Wayzata Blvd., Minneapolis 16, Minn.*

Circulation heaters

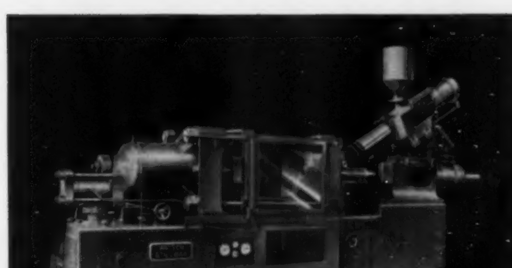
The heating of air for drying or preheating plastic powder is one application of the Vulcan line of electrical heat exchangers. They are also designed to heat water, oil, and steam. Tubular immersion heating elements are supplied in copper, steel, stainless, or alloy sheath. Housings are made of brass, galvanized iron, or steel. Sizes range from 5 to 120 kw., low or medium watt densities, and for all voltages up to and including 550 volts. Optional features include explosive-proof fittings and various types of thermostats for either normal or extra-close control. *Vulcan Electric Co., 88 Holten St., Danvers, Mass.*

Correction

"Dust-repelling cleaner." (MPl, June 1959, p. 50). "Like Magic" is distributed by Merchandise Presentation, Inc., 2191 Third Ave., New York 35, N. Y.—**End**

This styrene air-conditioner face, fresh from the W-S machine in the background, weighs 31 ounces.

Here's a good look at high-quality injection molding



The molded piece in the operator's hands will soon become the front of an air-conditioning unit. Clearly detailed, it's a fine example of injection molding turned out on one of two Farrel Watson-Stillman 90-ounce machines installed at Santay Corporation, Chicago.

Nationally known for custom-molding diversification, this corporation handles everything from the molding to the finishing and packaging of plastics products. Its extensive facilities are devoted to meeting customer requirements exactly.

Three more Watson-Stillman machines are scheduled for delivery to Santay's new Syracuse, New York, plant. One is a 175-ounce model, while the others have 90-ounce capacities.

Write for details of a Farrel Watson-Stillman injection molding machine that will meet your needs. Available in capacities from 5 to 500 ounces.

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WS-64

U. S. PLASTICS PATENTS

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 25¢ each.

U. S. Pats., Mar 31, 1959

Chlorinated polyesters. H. P. Marshall and R. E. Davies (to Celanese). 2,880,193.

Nitrogenous condensates of phenols and aldehydes. H. Hentschel and O. Sussenguth (to Rutgerswerke). 2,880,195.

Polyamides from diphenyl adipic acid. C. E. Frank and H. Greenberg (to National Distillers). 2,880,196.

Polyoxamines. D. Coleman (to Imperial Chemical). 2,880,197.

Polymerization of olefins. W. C. Lanning (to Phillips Petroleum). 2,880,198.

Polyolefins. J. L. Jezl (to Sun Oil). 2,880,199.

Olefin polymerization. M. Feller and E. Field (to Standard Oil). 2,880,200-1.

U.S. Pats., Apr. 7, 1959

Injection molding device. E. Gaspar, M. G. Munns, and P. F. Harrison (to Projectile and Engineering). 2,880,461.

Chlorosulfonated polyolefin. G. A. DiNorscia (to Goodrich). 2,881,098.

Apparatus for forming reinforced plastics. F. W. Walker, P. C. Cady, and L. B. Johnson (to Owens-Corning). 2,881,110.

Cellular vinyl plastics. W. J. Smythe (to Union Carbide). 2,881,141.

Polytetrafluoroethylene aqueous paste. J. E. Eldridge (to Du Pont). 2,881,142.

Alkyd resins from dicyclopentadiene. C. A. Cohen and L. A. Mikeska (to Esso). 2,881,144.

Cyanoethyl tetramethyldiamido phosphate in polyacrylonitrile. P. R. Graham (to Monsanto). 2,881,147.

Plasticized polyethylene. M. H. Dilke (to Distillers). 2,881,148.

Epoxy resin compositions. J. H. van der Neut and A. Renner (to Ciba). 2,881,149.

Stabilized chlorinated resins. D. W. Young and W. F. Fischer (to Esso). 2,881,151.

Substituted heterocyclic urea polymers. E. M. Hankins (to Rohm & Haas). 2,881,155.

Polyamide. D. E. Peerman and D. E. Floyd (to General Mills). 2,881,194.

U.S. Pats., Apr. 14, 1959

Treating plastics with electric glow discharge. G. H. Berthold, M. B. Karelitz, and A. S. Mancib (to Olin-Mathieson). 2,881,470.

Water-soluble polyamides. E. I. Valko, G. C. Tesoro, and E. D. Szubin (to Onyx Oil). 2,882,185.

Ion-exchange allyl phosphate polymers. J. Kennedy (to U. S.). 2,882,248.

Polyisocyanates. K. W. Posnansky (to Stamford Rubber Supply). 2,882,249.

Interpolymers of vinyl halides. R. M. Christenson (to Pittsburgh Plate Glass). 2,882,251.

Polyester composition. J. R. Caldwell (to Eastman Kodak). 2,882,255.

Polyester copolymer. W. F. Waychoff (to Monsanto). 2,882,256.

Polyester film. F. A. Hessel and G. Robinson (to General Aniline). 2,882,257.

Rubbery copolymers. R. L. Briggs (to Dow). 2,882,258.

Polymers with ureido cross-linkages. R. K. Graham (to Rohm & Haas). 2,882,259.

Cross-linked isocyanate polymers. H. Bartl, H. Holtschmidt, and O. Bayer. 2,882,260.

Acryloxyalkyl pyrrolidone polymers. D. A. Smith and C. C. Unruh (to Eastman Kodak). 2,882,262.

Iron-based catalysts. G. Natta, P. Pino, and G. Mazzanti (to Montecatini). 2,882,263.

Polymerization of ethylene. E. B. Barnes, J. E. Thomson, and G. A. Klumb, Jr. (to Dow). 2,882,264.

Graft copolymers. H. W. Coover, Jr. and J. B. Dickey (to Eastman Kodak). 2,882,290.

Polyesters of phosphonylidene diimino dibenzoic acids. J. R. Caldwell and J. C. Martin (to Eastman Kodak). 2,882,294.

U. S. Pats., Apr. 21, 1959

Plastic extrusion apparatus. G. E. Henning (to Western Electric). 2,882,555.

Plastic bag-making machine. H. C. Weist. 2,882,956.

Molded shell trailer bodies. B. Beckley. 2,883,233.

Continuous polymerization of organopolysiloxanes. N. Kirk (to General Electric). 2,883,272.

Cellulose propionate compositions. P. W. Kinney and J. H. Prichard (to Celanese). 2,883,299-301.

Ethoxyline-cyanurate-acrylate resin. D. A. Yamada, I. Katz, and J. C. Wilson (to North American Aviation). 2,883,308.

Anion-exchange resins. Y. Tsunoda and M. Seko (to Asahi Chemical). 2,883,349.

High-temperature-resistant molding compositions. O. Sorge (to Elektrische Gluhlampen). 2,883,352.

Polymerization of modified acrylonitrile. H. W. Coover, Jr. and D. J. Shields (to Eastman Kodak). 2,883,360.

Polyvinyl chloride resins. W. E. Leistner and A. C. Hecker (to Argus Chemical). 2,883,363.

Adducts of polyethylene and fumarates. J. Dazzi (to Monsanto). 2,883,367.

Acrylate surfactants. R. W. Rees (to Shawinigan). 2,883,369.

Copolymer of acrylonitrile, a quaternary compound, and another monomer. J. A. Price (to American Cyanamid). 2,883,370.

Sulfonyl triazine polymerization catalyst. W. M. Thomas, F. A. V. Sullivan, and W. B. Hardy (to American Cyanamid). 2,883,371.

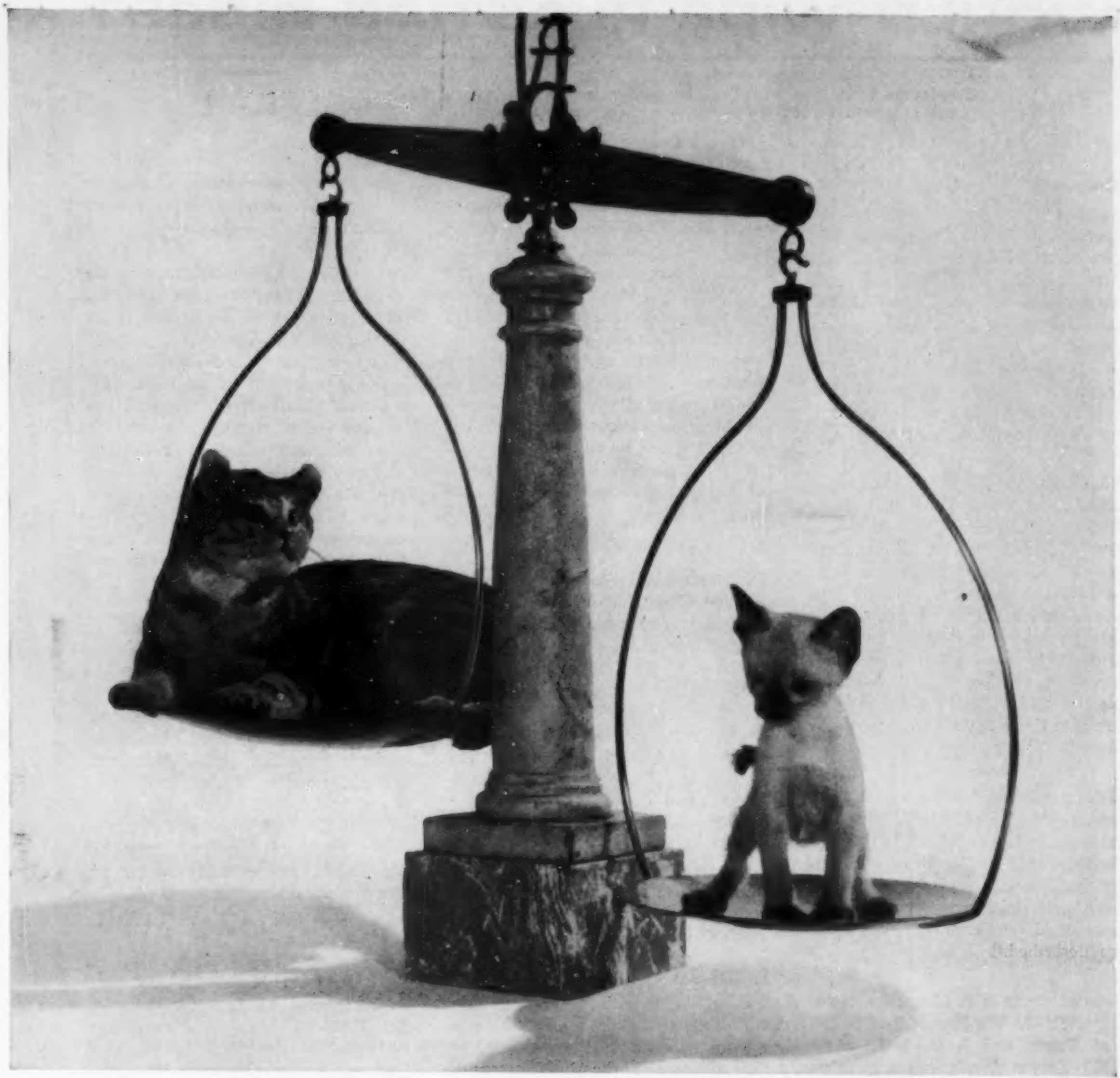
Copolymers of ethylene and dihydrodicyclopentadiene. G. S. Stamatoff (to Du Pont). 2,883,372.

Poly-N-vinylpyrole compounds. E. V. Hort and D. E. Graham (to General Aniline). 2,883,393.

U. S. Pats., Apr. 28, 1959

Injection molding machine for collapsible tubes. A. Quinche and E. Lecluyse. (to Bradley Container). 2,883,706.

Resin-bonded glass-fiber pipe. H. C. Fischer (to National Fiber Glass). 2,884,010. (To page 168)



WORLD-WIDE PLASTICS DIGEST

Abstracts from the world's literature relative to plastics. For complete articles, send requests direct to publishers. List of addresses is at end of this section.

General

Plastics in home building—the breakthrough may come sooner than you think. House and Home *15*, 132-34B, 210, 212 (Jan. 1959). The remarks made at a conference of plastics experts, architects, builders, and others on the uses of plastics in home building are summarized. The results indicate that the use of plastics in this field is rising and will be increasing at a more rapid rate.

Plastics up 10%. Canadian Plastics *1959*, 36-39, 42-47, 55 (Feb.). A statistical review of the plastics industry in Canada in 1958 is presented. Overall sales rose 10% above those in 1957 and passed the 300-million-pound mark. Over 25 figures and tables are used to illustrate the production, imports, exports, and consumption of the various kinds of plastics and resins in 1958, and to compare these figures with those for preceding years.

Plastics engineering 1957-1958. R. I. Leininger and R. A. Clark. Mechanical Eng. *81*, 54-57 (Mar. 1959). The developments in the plastics industry for the past year are reviewed. New materials, products, applications, and engineering knowledge are described.

Developments in condensation polymers. R. J. W. Reynolds. Plastics Inst. Trans. and J. 27, 44-50 (Apr. 1959). Recent developments in polyamides, polyesters, polyethers, and polyurethanes are described in detail.

Growth, competition keynote plastic film outlook. Chem. Week *84*, 40-42 (May 9, 1959). The growth of plastics films in packaging is discussed. Consumption statistics and materials packaged are considered.

What's new in plastics for engineering uses. M. W. Riley. Materials in Design Eng. *49*, 105-07 (Apr. 1959). Polyester resins have been designed to be molded at low pressures by compression and transfer molding. Glass-reinforced compounds require molding pressures of only 10 to 100 p.s.i. A new chlorinated epoxy resin has been designed for castings, pottings, or laminates, where flame resistance is required. Mechanical strengths of both castings and laminates are lower than those obtainable with other epoxies. The use of reinforced plastics for ultra-high temperature uses is described. The mechanism of ablation involves both thermal and mechanical effects. Thermal effects may include cracking or flaking away of expanded material, sublimation, run-off of melted material, pyrolysis, and combustion. Mechanical effects may include impact erosion due to local impact of particles in the gas stream, and shearing caused by fracture in wind stresses.

Materials

Plastics seek static-free market reception. Chem. Week *84*, 53-54 (May 23, 1959). Antistatic agents for use in molding compounds and on the surfaces of plastics are described.

C-oil, a new hydrocarbon thermosetting resin for reinforced plastics. H. Clark and B. M. Vanderbilt. Brit. Plastics 32, 69-71 (Feb. 1959). C-oil is described as an 80/20 copolymer of butadiene-styrene in which the butadiene functions essentially as a monoolefin, yielding a polymer containing vinyl side groups. The polymer has been used successfully as a binder resin for glass-reinforced laminates to produce light weight, translucent panels with good chemical resistance and excellent electrical properties. The preferred resin system consists of vinyltoluene, as the monomeric crosslinking agent, and a mixed catalyst of dicumene peroxide and di-*tert*-butyl peroxide. Best results were obtained with laminates containing glass fiber sized with a vinyl silane type finish.

Borohydrides make better foams. Chem. Eng. News 37, 38-9 (Apr. 6. 1959). Activated borohydrides are used as blowing agents for vinyl chloride plastic foams.

Polyester laminates for material of communication apparatus. K. Yanagihora, T. Suzuki, and Y. Gomi. Reinforced Plastics *4*, 6-12 (1958). Polyesters were prepared by reacting maleic anhydride with diethylene, triethylene, propylene and dipropylene glycols, 1,3-butanediol, and 2,2-dimethyl propanediol. The effects of molecular structure on shrinkage during cure, thermal expansion, dielectric constant, impact strength and water absorption were studied.

New plastic bridges temperature gap. Chem. Eng. *66*, 194, 196, 198 (Mar. 23, 1959). A new plastic, polybischloromethyl oxetane, a chlorinated polyether, is described. It is a linear material that can be molded to close tolerances on standard injection and extrusion equipment. It has excellent chemical resistance and can take temperatures of about 250° F. From a performance standpoint it falls into a category between polyvinyl chloride and the fluorocarbons. Some mechanical properties are given.

Polyvinyl alcohol. R. E. Grandpre. Plastics World *17*, 16-17 (Mar. 1959). The properties and uses of polyvinyl alcohol resins are reviewed. These resins are used in adhesives, sizing, finishes, coatings, binders in ceramic products, emulsions, films, gaskets, nozzles, tubing, mold releases, and printing plates. They are compounded in a manner similar to other thermoplastics and may be crosslinked by radiant energy or chemicals.

Thermally stable high molecular weight polyoxymethylenes. C. E. Schweitzer, R. N. MacDonald, and J. O. Punderson. J. Appl. Polymer Sci. *1*, 158-63 (Mar./Apr. 1959). The historical development of formaldehyde polymers, beginning with the work of Butler and continuing through the investigations of Staudinger and his collaborators, is reviewed. Recent studies have led to thermally stable high polymers of formaldehyde. Initiators and the role of impurities in the polymerization are described. An explanation is offered to account for differences in thermal stabilities between old and new polymers. Esterification, by which further increases in thermal stability are achieved, is described.

Molding and fabricating

Mechanical processes of blow molding. G. S. Brown. Plastics World *17*, 18-21 (May 1959). The process for blow molding of plastic bottles is reviewed in detail.

High-density cellular vinyl by direct extrusion. R. J. Meyer **(To page 54)**

(From page 52)

and D. Esarove. Plastics Tech. 5, 32-37, 50 (Apr. 1959). Cellular vinyl chloride plastics are made by direct extrusion by including a gas-forming agent in the compound. This agent decomposes in the process.

Successful machining glass-base laminates. E. C. Graesser. Canadian Plastics *1959*, 42-43 (Jan.). Information is given on the proper choice of equipment and the best techniques to be used for sawing, shearing and slitting, punching, drilling, tapping and threading, turning, boring, facing, and milling of glass-fiber reinforced plastics laminates.

Chemforming cuts scrap loss. Chem. Eng. News *37*, 36 (Apr. 6, 1959). Thin-wall moldings are made from Teflon by a new process.

Applications

Plastic materials in the oenological industries. M. Simonich. Poliplasti 7, 8-9 (Jan./Feb. 1959). The use of plastics items in equipment for producing wine is described.

Nonmetals for built-in conveyors. A. R. Gardner. Prod. Eng. *30*, 51-3 (Apr. 27, 1959). Nonmetallic conveyor belt materials are discussed. When the maximum temperature is 250° F., nylon, polyester plastics, and various cotton combinations are suitable. Spun nylon gives the highest abrasion resistance and polyesters, glass, and nylon are all resistant to attack by moisture. Other combinations with canvas backing and design criteria are also discussed.

How "Fused-film" Teflon wire insulation process saves space. J. I. Cohn. Insulation 5, 30-31 (March 1959). A process for fusing Teflon tape after it is wound around a wire is presented. Thinner wall thicknesses for equal insulating properties are possible, resulting in considerable saving in space when many wires must be used. Electrical properties of the fused film are presented.

Production-, quality-, and permeability-control of plastics pipes. E. Nümann and O. Umminger. Kunststoffe *49*, 113-16 (Mar. 1959). The use of plastics pipes for the conveyance of drinking water is widespread. Such pipes must meet a number of stringent requirements. The purpose of quality control is to insure that a pipe made with rigid polyvinyl chloride and normal and rigid polyethylenes will have a useful life of 50 years. Control during manufacture is to insure that the quality of the pipe remains at a constant level throughout the manufacturing process. It is advisable to carry out quality control at elevated temperatures to detect any peculiarities that would influence long-term behavior.

Properties

Effect of spherulites on the mechanical properties of nylon 66. H. W. Starkweather, Jr. and R. E. Brooks. J. Appl. Polymer Sci. *1*, 236-39 (Mar./Apr. 1959). The presence of spherulites in nylon 66 increases the yield point and reduces the effects of variations in percent crystallinity. Decreasing the size of the spherulites through increased nucleation results in a higher flexural modulus and yield point, a lower ultimate elongation, and a loss of ductility. These effects are markedly reduced by raising the temperature or water content. The effects of spherulite size in nylon and grain size in metals such as mild steel are compared.

Degradation of cellulose acetate films. W. K. Wilson and B. W. Forshee. SPE J. *15*, 146-56 (Feb. 1959). Several commercial cellulose acetate films and several experimental films of cellulose acetate, cellulose acetate butyrate, cellulose acetate propionate, and cellulose propionate were evaluated for stability to laboratory aging at elevated temperatures. The effects of moist and dry oxygen and nitrogen were studied at various temperatures up to 124° C. Plasticizers of the aliphatic ether-ester type were found to greatly accelerate degradation. Anti-oxidants, stabilizers, and acid acceptors are required components of films with good aging characteristics. Data are presented on the activation energy of degradation, effects of degradation on intrinsic fluidity, and stress-strain properties.

Extrapolation, safety factors, and maximum working pressures relating to polyethylene and PVC pipes. K. Richard and R. Ewald. Kunststoffe *49*, 116-20 (Mar. 1959). Consideration of the curves for long-term tensile strength and long-term elongation leads to a maximum working pressure of 710 p.s.i. at 20° C. for Ziegler polyethylene pipe, using a suitable safety factor. The maximum working pressures are at the moment fixed at 360 p.s.i. for all types of normal polyethylene pipes. The long-term behavior of rigid PVC pipes differs considerably according to the particular type. Present day recommendations concerning quality control of rigid PVC pipes do not guarantee rejection of pipes having insufficiently high tensile values. Only when the question of quality control has been satisfactorily solved will it be possible to start considering the maximum working pressure for rigid PVC pipe, hitherto assumed to be 850 p.s.i.

Study of particles present in some high-pressure polyethylenes. L. D. Moore, Jr. and V. G. Peck. J. Polymer Sci. *36*, 141-53 (Apr. 1959). Scattering of light by solutions of high-pressure polyethylenes reveals that very large particles are present. These particles are not quantitatively removed by filters having a rated pore size of a fraction of a micron. By etching and shadowing films, electron photomicrographs revealed the physical appearance of the particles. Their shape, solubility, and behavior on pyrolysis strongly indicate that the particles are actually polyethylene molecules of very high molecular weight—perhaps 40,000,000. It is quite probable that these photomicrographs show the largest polyethylene molecules that have ever been observed individually and reported.

Effect of extraction agents on plasticized polyvinyl chloride mixtures. R. Reichherzer. Mitt. Chem. Forschungs Inst. Wirtsch. Osterr. *12*, 129-31 (1958). The results of extraction tests on polyvinyl chloride plasticized with 16 different plasticizers are given. No plasticizer is stable against all extraction agents, but mixtures can be made which are practically resistant to attack by certain liquids. Phthalates of C_8 and C_{10} alcohols are usually very stable to water.

Chemistry

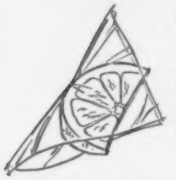
A convenient laboratory preparation of isotactic polystyrene. C. G. Overberger, F. Ang, and H. Mark. J. Polymer Sci. 35, 381-89 (Mar. 1959). Reaction conditions for improving the yield of the crystalline fraction of the product obtained on polymerization of styrene with a heterogeneous catalyst system were determined. The best reaction temperature at atmospheric pressure was found to be about 70° C. Initial ratio of triisobutylaluminum to titanium tetrachloride, **(To page 170)**

U.S.I. POLYETHYLENE NEWS

A series for plastics and packaging executives by the makers of PETROTHENE® polyethylene resins

AUGUST, 1959 U. S. Industrial Chemicals Co., Division of National Distillers and Chemical Corporation 99 Park Ave., N. Y. 16, N. Y.

Packaging Notes



Helpful Hint: We've seen squares of polyethylene film being used to package lemon slices served with iced tea in restaurants.

The covering makes lemon squeezing more convenient and sanitary. It eliminates the problems of sticky fingers and lemon juice stains on clothes, and prevents contamination from handling. Small size tubing cut in proper lengths could be used for the same purpose.

Skim milk powder is being packaged in printed polyethylene bags. The bag holds three pounds of instant milk powder, the equivalent of 12 quarts of liquid milk.

The side-weld, pinch bottom polyethylene bag costs less than conventional foil wrapped boxes now generally used to package milk powder.

Cast polyethylene film made from U.S.I. PETROTHENE resins, is being used with success in two new applications:

A Texas manufacturer is using cast film bags to package tortillas. He reports that the bags are clearer and seal better than conventional wax paper bags. Polyethylene film reportedly provides longer shelf life for the tortillas and has virtually eliminated the problem of stale product returns.

Cast polyethylene is also being used to package hosiery. The clear, high gloss cast film has met with good consumer acceptance. The film is tougher than previous transparent materials used, and returns from damaged packages have been greatly reduced.

Both manufacturers report that use of polyethylene film has significantly lowered their packaging costs.

U.S.I. Wins Three Awards For Polyethylene Promotion

U.S.I. has won three top industrial advertising awards for its 1958 advertising and sales promotion campaign for PETROTHENE polyethylene resins. An important factor in all three awards was U.S.I.'s industry wide promotion of new markets for polyethylene and higher quality standards for products made of polyethylene.

The competitions in which U.S.I. was honored are: National Industrial Advertisers Association Best Seller Awards; The Putman Awards for Advertising Performance; and the American Business Publications Awards.

Imagination Creates New Markets, New Uses For Polyethylene in Sports, Vacation Fields

New Products, New Ideas for Using Film Add to Summer Fun Everywhere

Imagination — on the part of consumers as well as designers and manufacturers — has contributed to a virtually endless list of new uses for polyethylene that have been in evidence this summer.

Utility coverings of polyethylene, available in most hardware and paint stores, make ideal rainproof protection for boats, sports cars, and most anything else that is kept outdoors.

A survey of products designed for the leisure market shows that polyethylene's versatility has created major new sales opportunities in the sports and vacation fields.

Many Marine Applications

Polyethylene's water and corrosion resistance, for example, have been put to good use in products for beach and boating enthusiasts. Boat fittings and bilge pumps are being molded from polyethylene. Bait and fishing equipment boxes made from polyethylene are colorful, lightweight and waterproof. Deck brushes, made completely of polyethylene, including the bristles, do not rot or mildew in damp sea air, are easily cleaned. Ice buckets, thermos jugs, coolers, and picnic baskets are just a few of the great many new leisure time products that capitalize on polyethylene's durability and insulating properties.

Juvenile Market Important

Manufacturers have found that polyethylene serves the juvenile market well. Golf clubs with polyethylene heads, for example, are inexpensive and strong enough for youngster play. Backstops for backyard golf ranges and baseball batting cages are now made of polyethylene film.

Consumers Find New Uses for Film, Pipe

Consumers have thought up scores of uses of their own for polyethylene film.

House plants can be kept for weeks during the family's absence by wrapping them in film. And vacationers have found polyethylene film invaluable when they take it along on trips. As a temporary covering, it can serve for everything from an umbrella in case of showers to coverings for boats, sports cars, camping equipment, and outdoor furniture. It's handy at the beach for wrapping up wet beach clothes or for protecting the car upholstery on the way home. And for the home-improvement vacationer, polyethylene film can protect new lumber, fresh concrete, or even newly planted grass plots.

Polyethylene pipe is also coming into its own for all sorts of easily installed water supply and sprinkling systems.

This Is Only The Beginning

Molders and extruders are just beginning to exploit polyethylene's potential in this market. It gives promise of large volume sales as processors begin to promote its versatility and move it into sporting goods, camp supply, hobby, and do-it-yourself type outlets.

Polyethylene Film Reduces Highway Construction Costs

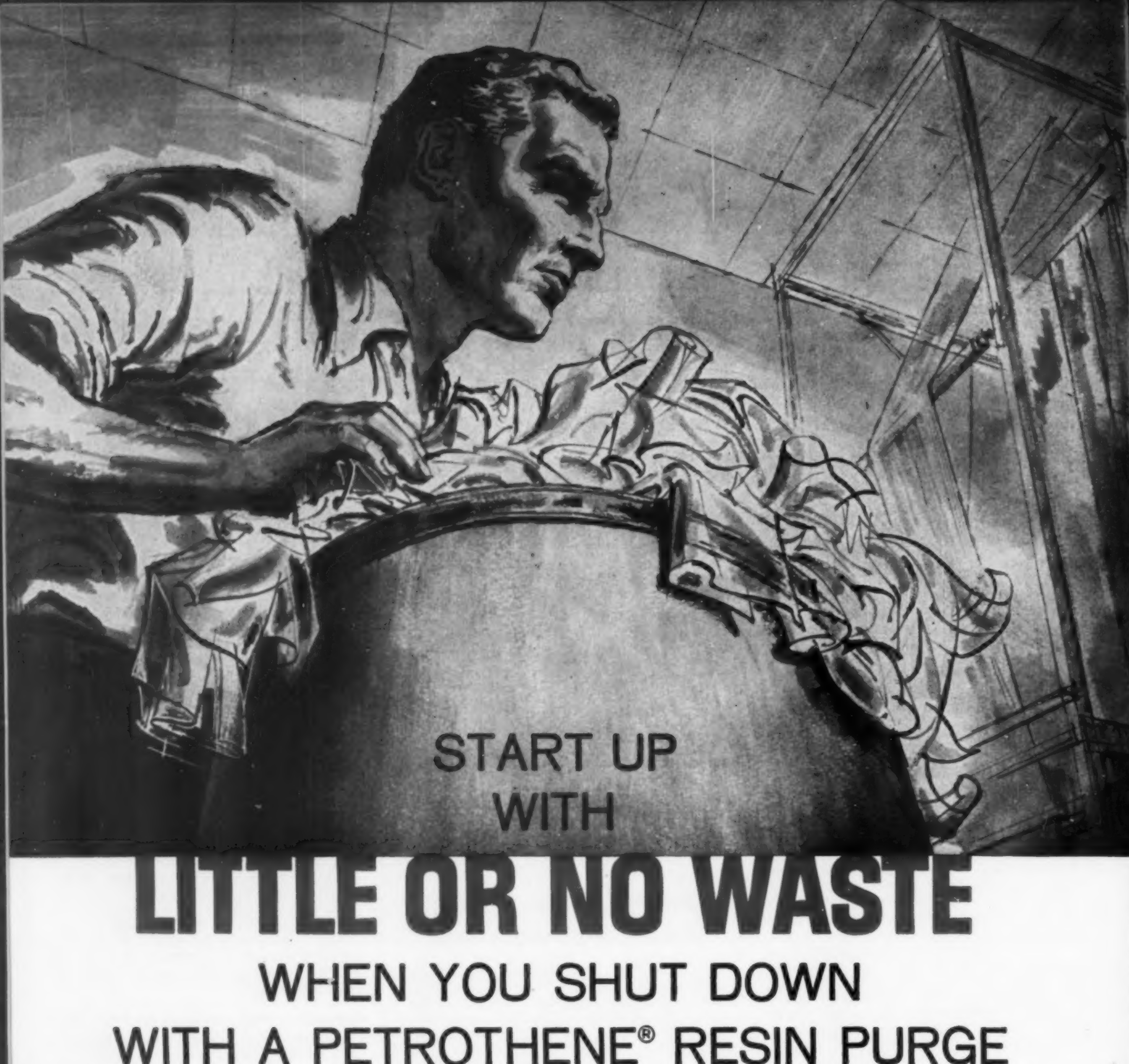
A Canadian construction company, which has just completed a 180-mile concrete super highway, reports using rolls of polyethylene film, both as a barrier between the fresh concrete and the gravel base, and as an overcovering.

Use of the polyethylene film eliminated concrete leakage into the gravel base, resulting in a seven percent saving in concrete. Slower curing gave a fifteen percent increase in concrete crush strength. The cover film, re-used more than 20 times, also substantially lowered labor costs.

Polyethylene Pipe Helps Form Ice Bridge Across River

In a unique application, cold brine circulating in polyethylene pipe helped form a natural ice bridge across a Canadian River. The "bridge" made possible the passage of trucks with 25-ton loads for a period of three weeks. The ice bridge was built up with water sprayed on top of the pipe to a three foot thickness.

Polyethylene pipe was chosen because of its low temperature flexibility. The "bridge" was removed after use by circulating warm brine through the pipes to melt the ice.


START UP
WITH

Air Pressure Alone Holds Up World's Largest Fabric Dome!

the problem: **To provide a large missile shelter of economical construction, easily transported and quickly erected.**

the solution: **The Pentadome, made of vinyl-coated nylon, easily transported, quickly erected by ten men in one day.**

Procured by the U. S. Army Quartermaster R & E Command for use by the Ordnance Corps, the Pentadome provides missiles and their crews with ideal protection from dust, rain and high winds. The main dome, 85 feet high, 150 feet in diameter, and four smaller connected domes 50 feet high, 100 feet in diameter, are wholly supported by internal air pressure supplied by blowers. Domes can withstand a gale of 70 miles an hour or more.

Birdair Structures, Inc. specified that the 18,000 square yards of nylon base fabric for vinyl coating be by Wellington Sears. Designed to retain flexibility at −40° F., it is the heaviest single-ply fabric ever used in an air-supported structure.

Wellington Sears, with over a century of experience, would welcome the opportunity to help you solve problems related to fabrics, in rubberizing, coating, laminating, or any combination of textiles with other materials. For a useful booklet, "Fabrics Plus," write Dept. K-8.

Preparing to put up Pentadome, made by Birdair Structures, Inc., Buffalo, New York. Wellington Sears nylon base fabric was vinyl-coated by Sawyer-Tower, Incorporated, Watertown, Mass.

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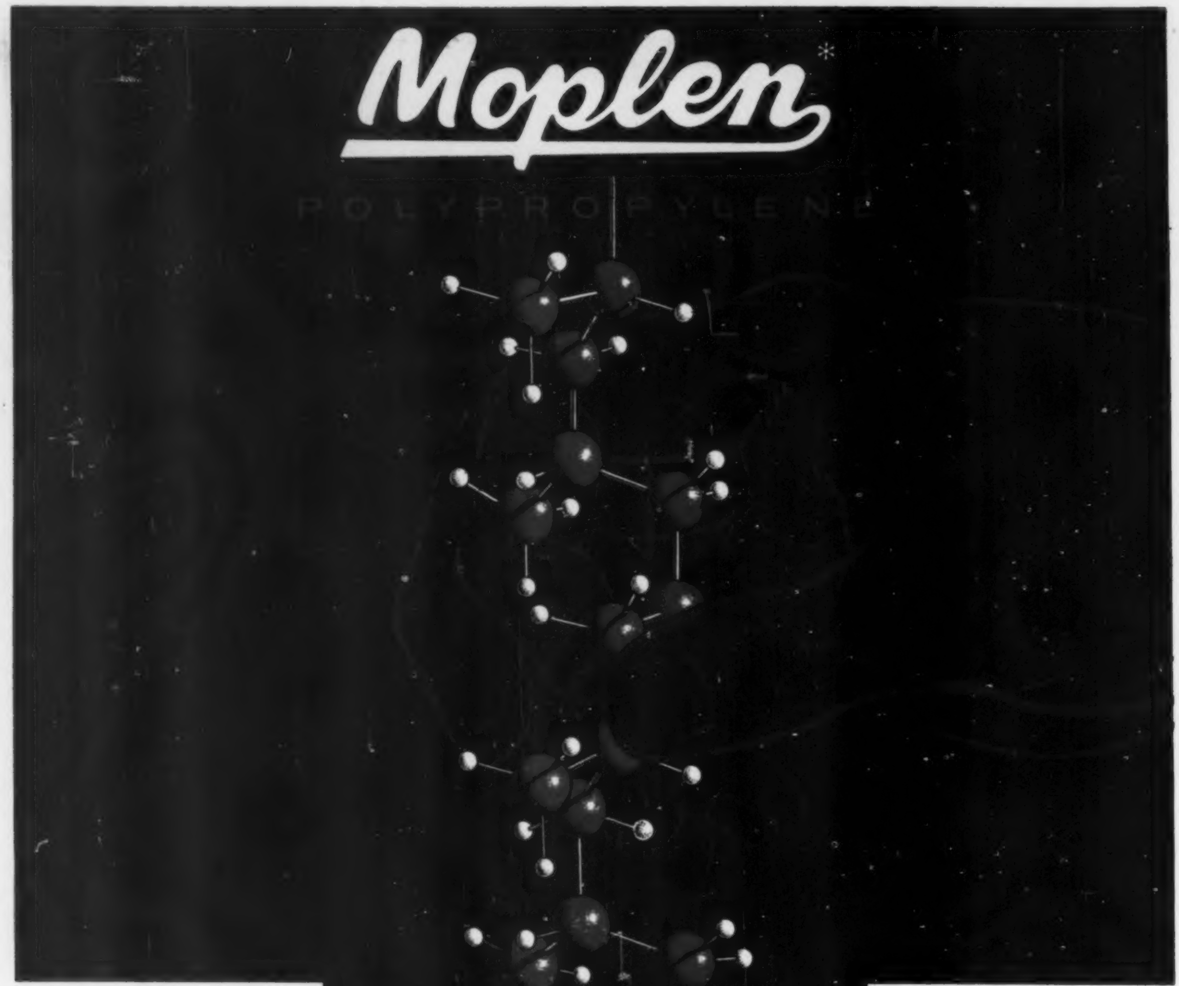

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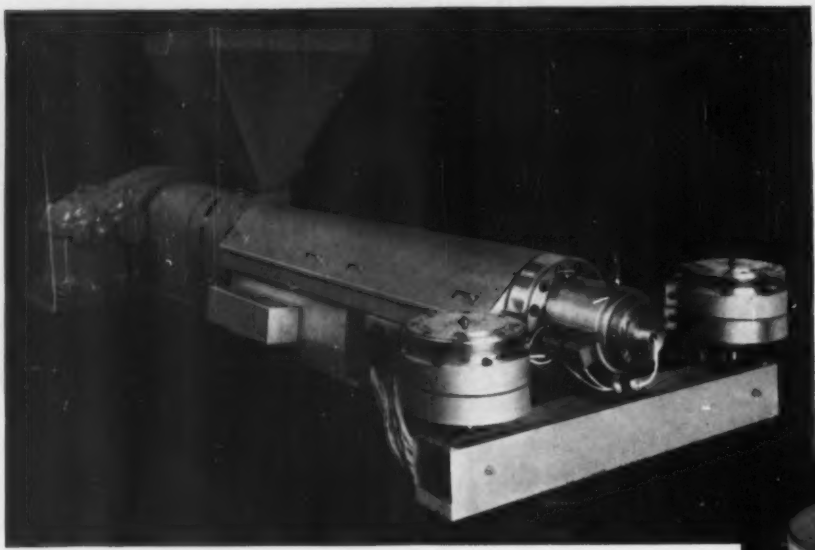

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Egan Extruders offer distinct advantages in any blown film installation! A low base permits extra cooling space, and easier access to dies and feed section. The manifold arrangement, illustrated on the above 4½″ extruder, permits full output even when using small dies. The manifold is valved so that one side only can be used, if desired. Complete engineering data available upon request, covering the full line of Egan Heavy Duty Extruders.

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No weld lines
More uniform gauge
Better quality film

The Standard 24″ Egan Die shown above has a center feed arrangement, incorporating a specially designed mandrel. It eliminates "weld lines," and assures uniform pressure at the die orifice. The result is a more uniform gauge and better quality film!

Egan Dies are available in a wide range of sizes.

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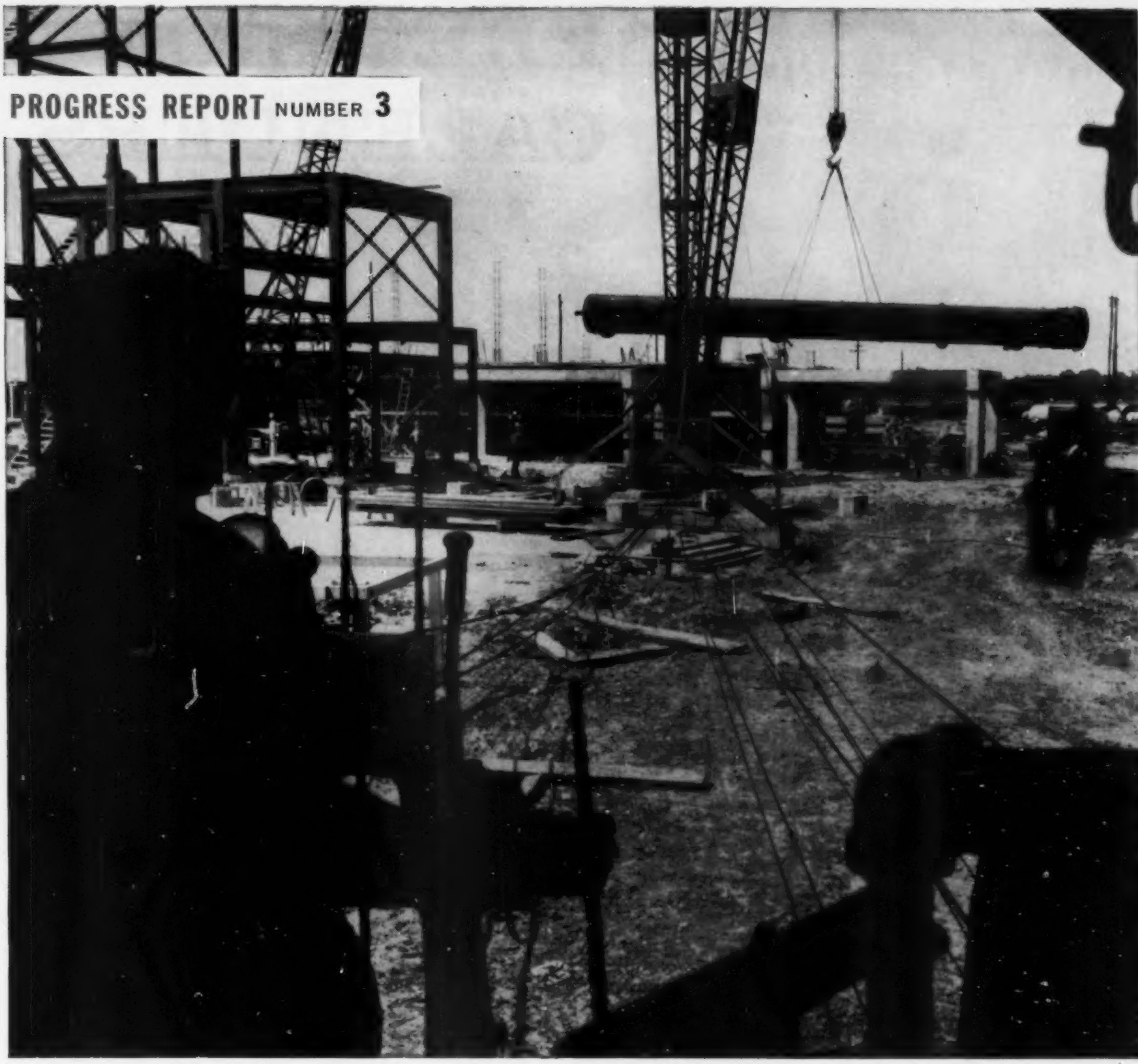

New Plant to Produce
ENJAY POLYPROPYLENE

Shown above is America's newest and most modern polypropylene plant, now under construction by Enjay's affiliate, Humble Oil & Refining Company, at the latter's Baytown, Texas, refinery. The plant is designed for initial production of 40 million pounds of polypropylene per year, with future expansion to 100 million pounds per year. Construction is progressing on schedule and polypropylene will be available for sale by Enjay early in 1960.

Already nearing completion are Enjay's new Technical Service laboratories at Linden, New Jersey. Enjay will offer industry a polypropylene with the utmost versatility in its physical and chemical properties. This polypropylene is a material that meets rigid industrial specifications. Its ease of color fabrication means greater eye-appeal to boost consumer sales. Combine these important qualities with low specific gravity and low initial cost, and you'll see why it might be wise to begin now to consider a change-over...to Enjay Polypropylene!

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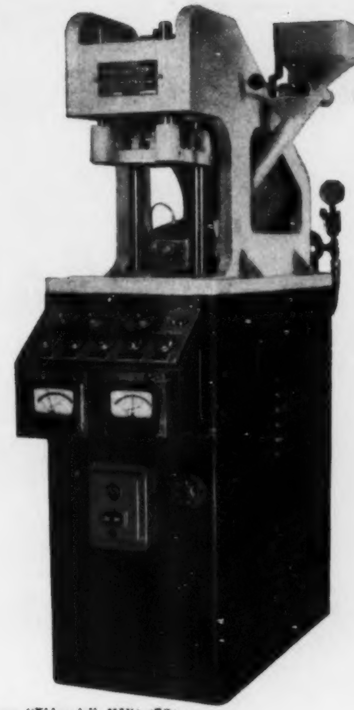
ENJAY
PLASTICS

For profitable plastic injection molding especially of parts involving inserts or loose cores . . . the

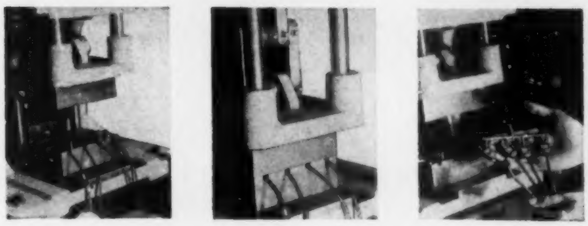
"Eldorado" MINI-JECTOR

Reg. U. S. Pat. Off

PLASTIC INJECTION MOLDING MACHINES



Super "Eldorado" MINI-JECTOR, model 70VC105 (above) offers semi-automatic operation in addition to all the advantages of the Standard "Eldorado," model which is lever controlled.

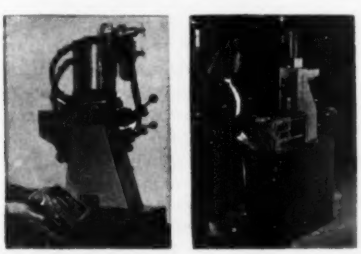


Typical example of insert molding on "Eldorado" MINI-JECTOR. *Left*—Close up of mold in open position. Note unobstructed access to mold area. *Center*—Close up of mold in closed position. *Right*—Cycle completed. Molding of cord ending shown represents only one of hundreds of applications, but as they are familiar objects, it is easy to visualize the capacity range of "Eldorados."

"Eldorado" MINI-JECTORS are designed to solve a specific injection molding problem. They are the ideal answer to **fast**, low-cost production of parts (sub-miniature to 1½ oz.) involving inserts or loose cores. "Eldorado" MINI-JECTORS are daily molding a wide variety of precision parts in all thermoplastics.
The "Eldorado" MINI-JECTOR is hydraulically operated and is available either with lever controls or for semi-automatic operation.

There's a MINI-JECTOR to fit your needs!

MINI-JECTORS are available in 3 basic models. "WASP" models have self-clamping "V" molds—ideal for sub-miniature to ¾ oz. items especially those involving inserts or loose cores. "HORNET" models feature horizontal clamping—capacity up to 1 oz. "ELDORADO" models feature high speed molding, especially of parts involving inserts or loose cores up to 1½ oz.



Two of the popular stock MINI-JECTOR models. **Left**—"Wasp," with air or hydraulic power provides capacity from sub-miniature to 1-oz. Uses small "V" molds. **Right**—"Hornet" MINI-JECTOR has horizontal clamping and mold area of 6" x 5 1/8" x 5". Molding capacity up to 1 oz.

You'll like these outstanding "Eldorado" features:

- **No front tie rods** to hinder operator's easy access to mold area when mold is open.
- **Vertical Clamp Operation**—Inserts or loose cores remain undisturbed because bottom of mold is always stationary.
- **Simple to Operate**—No special skill needed for efficient operation.
- **Hydraulic Power**—Self-contained Vickers hydraulic system powers mold closing and injection.

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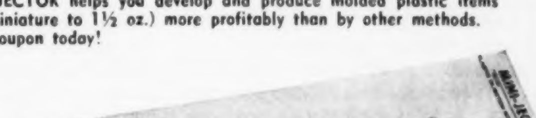
New, over 50 pages of detailed, illustrated, complete engineering data and specifications on all MINI-JECTOR models and accessories. *Contains complete price list.* Many money-saving exclusive features. Shows how MINI-JECTOR helps you develop and produce molded plastic items (sub-miniature to 1½ oz.) more profitably than by other methods. Mail coupon today!



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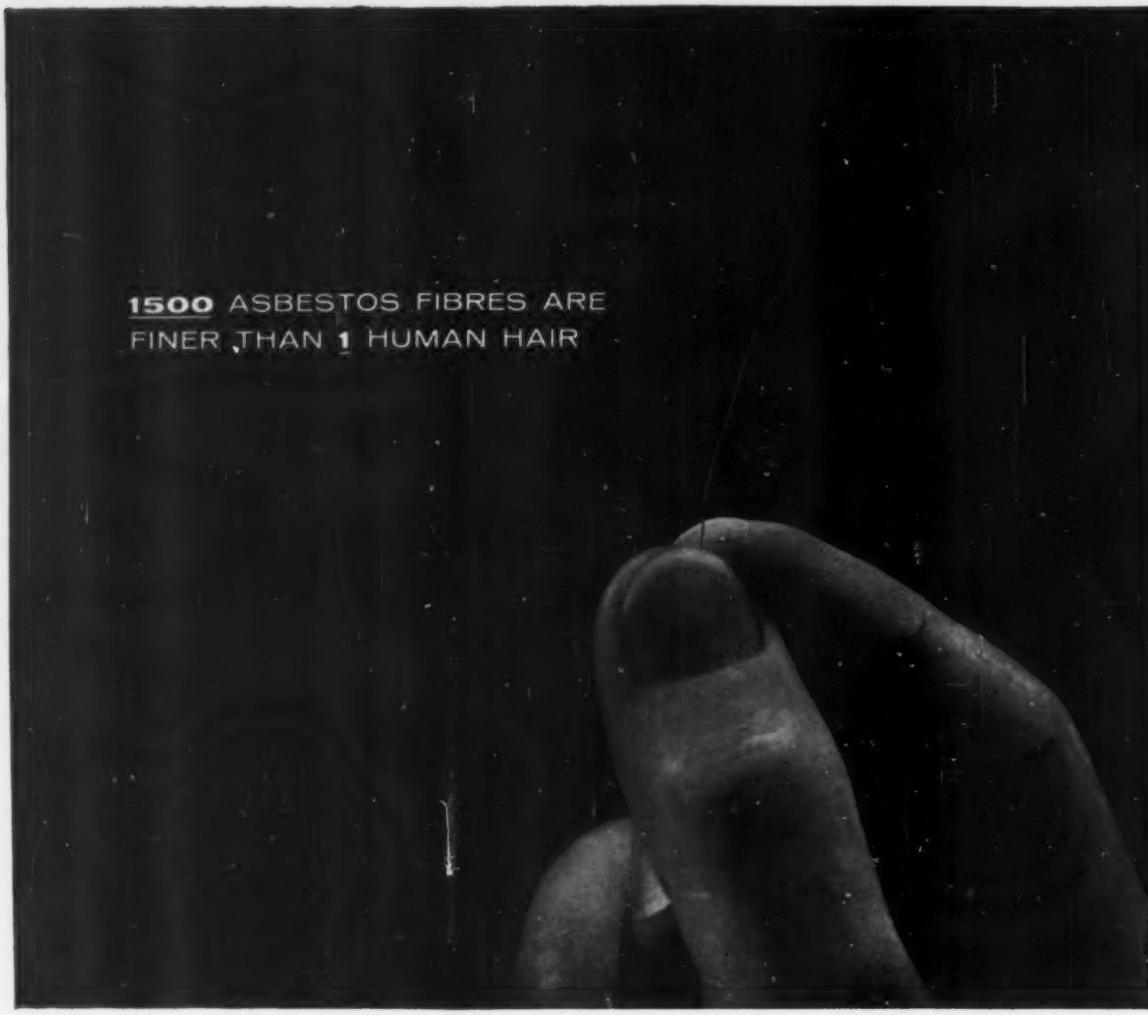

The diameter of asbestos fibre in inches ranges from 7.06×10^{-7} to 11.8×10^{-7}. Shown above is not just one but a number of strands.

The **fineness** of J-M Asbestos Fibre assures higher loading, greater strength for your plastics

THE BROAD COVERAGE and dispersability of Johns-Manville Asbestos Fibre . . . plus its exceptionally high tensile strength . . . can add competitive advantages when used as a plastics reinforcer for products ranging from floor tile to molded electrical parts.

Compare the coverage of this J-M "magic mineral" with glass fibre: only 4,000 glass fibres to one linear inch . . . as many as 1,000,000 asbestos fibres in the same space!

Compare its amazing strength with ingot or wrought iron: greater than an equal thickness of either one!

In addition to these two outstanding properties, you will find J-M Asbestos Fibre, because it is of the Chrysotile variety, provides the best combination of properties offered by any filler on the market. It bulks, reinforces, controls impact strength, improves dimensional stability. In addition, you can depend on J-M Asbestos Fibre to reduce molding costs whether you work with thermoplastic, thermosetting, or cold-molded plastics.

If you would like more information on how you can improve plastics with the J-M "magic mineral," write for your free copy of brochure AFD-8A. Address: Johns-Manville, Asbestos Fibre Division, Box 1500, Asbestos, Quebec, Canada.

Characteristics of J-M Chrysotile Asbestos used in the Plastics Industry:

Type of Asbestos: Chrysotile

Specific Gravity: 2.4—2.6

Color: Dry: Light gray—Wet: Dark gray

Approximate Chemical Analysis:

MgO	.40-42	FeO	.Tr-6
SiO_2	.38-42	Fe_2O_3	.Tr-6
H_2O	.12-15	Al_2O_3	.Tr-3

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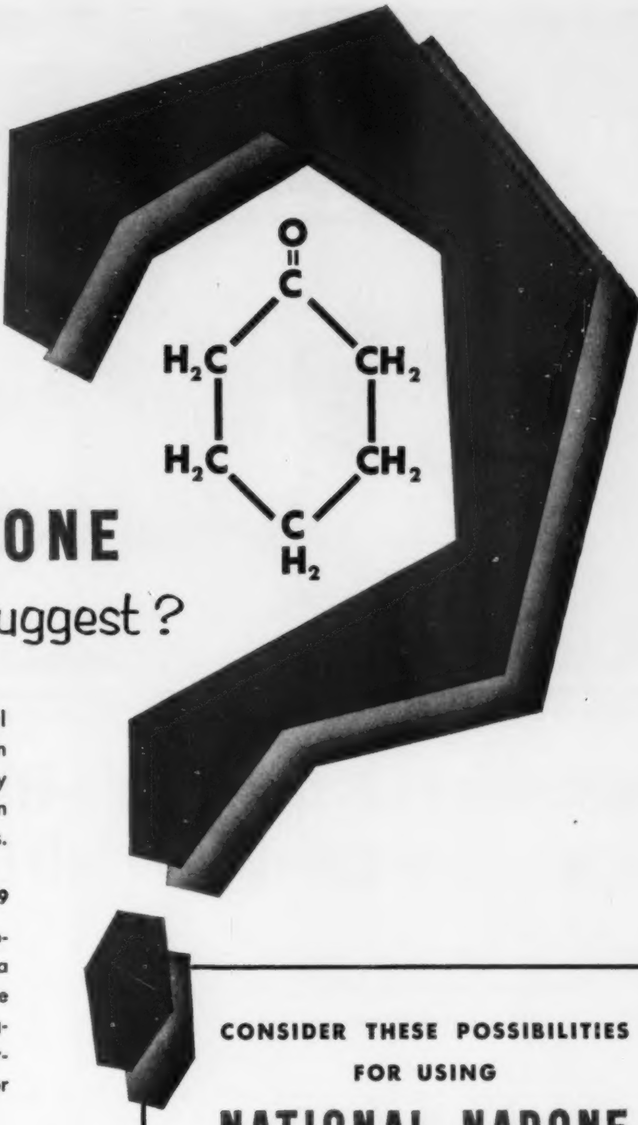

National® NADONE is one of the most powerful solvents available today. It is also a useful resin intermediate. But its solvent power and reactivity as an intermediate are yet to be fully employed in the development of new and better end-products.

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as an ingredient in more potent paint removers

for inks, adhesives, leather finishes, insecticides, pharmaceuticals and other compounds

August 1959, Volume 36, Number 12

MODERN PLASTICS

3 new cost cutters

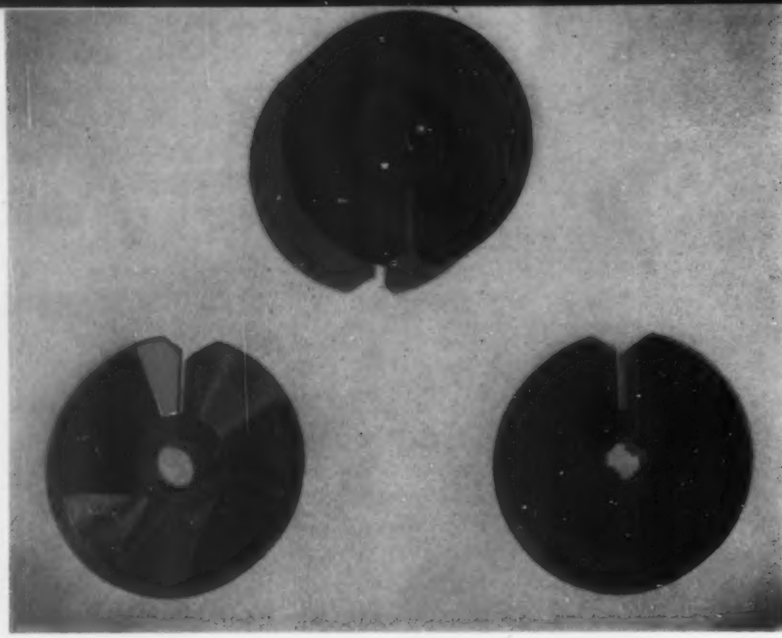
Spectacular premium-priced thermoplastics replace expensive metals and other design materials because they match their properties but are lighter in weight and need no finishing

POWELL Y-type globe valve, Penton-lined, has been in service in cold HCl for two years and eight months. Inset pictures ¾ in. aluminum Hills-McCanna diaphragm valve with Penton lining. Cutaway shows thickness of Penton lining and its position in assembly. Valves are available in either aluminum or cast iron, in sizes ranging from ½ to 6 inches.

For so-called "premium-priced" plastics, the three lusty new babies of the industry—Delrin (Du Pont's acetal resin), Lexan (General Electric's polycarbonate resin), and Penton (Hercules' chlorinated resin derived from pentaerythritol)—certainly seem to have marshalled up enough impressive cost savings figures to put some of their brethren at the lower end of the price scale to shame. And, as this article will attempt to show, many of their arguments are well taken and much of what their makers have to say about them merits attention.

Right now is about the ideal time to pay this attention. Du Pont, for one, expects its Delrin plant to be on stream in late summer.

First commercial sales of Lexan were made from a large-scale pilot-plant unit that went on stream in August, 1957. In 1958, a small commercial unit in the semi-works category went on stream and in June 4 of this year, a multi-million-pound commercial plant was an-



PENTON "wobble plate" for water meter replaces brass disk and carbon half ball with a 1-piece injection molded part having greatly superior wearing properties. New "wobble plate" at top shows actual dimensions of slot in disk prior to use. In brass plate of type formerly used (lower left), color indicates how slot enlarged after 100,000 gal. of hot water service to point where meter ceased to function properly. Penton disk (right) shows little wear after being subjected to same 100,000 gal. service.

nounced with a scheduled start-up date of sometime during the third quarter of 1960. The present semi-works plant is being expanded to meet the demand in advance of the full-scale commercial operation.

And Hercules has for some time offered Penton from a primary production unit.

For thermoplastics—a new concept

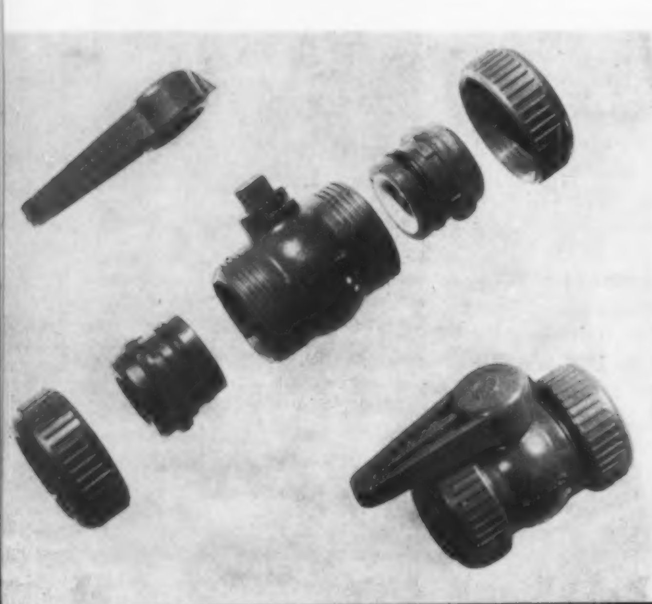
If nothing else, the three new plastics, as a group, have certainly made end-users sit up and take notice of the explosive changes which have been shaking up the family of thermoplastics as they've never been shaken before. The change began subtly some years back when the nylons and fluorocarbons appeared on the scene to make users aware of the fact that not all thermoplastics need be brittle nor easily susceptible to impact or high temperatures—even though a premium price was attached to the new advantages. The change was even more intensified when polypropylene made its debut—and to many, it has reached its culmination with the introduction of the three new materials.

For here, at their level, are three thermoplastics materials that can compete with metals, wood, and glass from the standpoint of such properties as strength, temperature resistance, and ease of fabrication—and can compete economically.

The bugaboo of premium pricing always seems to disappear when one considers the competition these materials are going to come up against—not other plastics that sell for 20 to 30¢ a pound, but metals and other conventional materials that are heavier, that involve more expensive machining costs, and require more material and more intricate design to achieve the same objective as a molded piece.

Figures speak for themselves

Du Pont, for one, estimates that up to 75% of the markets they expect to go into with Delrin are those now dominated by aluminum



CHEMTROL'S ball valve, shown in complete and disassembled form, is molded of Penton in pipe sizes from ½ to 3 inches. Because of its chemical inertness and excellent mechanical properties, Penton is being used in Chemtrol's complete line of ball, needle, and globe valves.

and zinc die castings, brass castings, stainless steel, and even carbon steel. They are confident of these markets and to back up this confidence they offer price comparison data such as is illustrated in Fig. 1, right. The data were predicated on a typical industrial part. In Delrin, it was estimated the part would weigh only 2 oz.; equivalent weights of a brass part would be 12.3 oz., of a zinc part, 9.3 oz., and of an aluminum part, 3.7 ounces. Even with today's base price of 95¢/lb. for Delrin, the raw material cost of the plastic is in a competitive range.

But when one takes into account fabrication and finishing costs, then plastics really begin to shine. In the figures in Fig. 1, it was assumed that the Delrin part would be injection molded in one completely finished piece. The die cast zinc and aluminum parts were figured for two levels of finishing: moderate finishing which would involve flash removal plus several machining operations, such as facing, reaming, or tapping; and extensive finishing which would take in chrome plating or a large number of machining operations requiring jigs and fixtures. Finishing on the cast brass part included flash removal and several machining operations or a screw machine part (with credit being taken into account for the scrap value of turnings).

A quick glance at the chart and it is obvious that on the finished part, Delrin is not merely competitive—it's cheaper!

From Hercules comes a similar set of figures. In Penton's case, where prime markets revolve around the material's exceptional corrosion resistance, the competing metal is not simply die cast parts, but the special *premium-priced corrosion-resistant metals*—and machined metals at that.

When one takes into account the specific gravity of Penton (at $3.50/lb.) as opposed to metals, the sales price per cu. in. averages out to about 17.5¢ for Penton, 23¢ for stainless steel, 38¢ for nickel, and 80¢ for Hastelloy C. (See Fig. 2, right). Going one step further (See Fig. 3, p. 70) and again taking into account the finishing operations, a typical molded Penton valve would sell for $4.50, as opposed to $8.75 for a 316 stainless steel valve, and $21.45 for a Hastelloy C valve!

It would hardly be any trick to take into account the specific gravity of Lexan (at $2.50/lb.) and come up with equally as impressive a set of figures (See Fig. 4, p. 70). At its current introductory price, Lexan is already less expensive on a cost/unit volume basis than brass, bronze, and copper. With anticipated cost reductions, its competitive position will be even better.

And potential users of all three materials would do well to note that prices eventually have only one place to go—and that's down! It has only been in the past month or so that Hercules dropped the price of Penton from $6 to the present $3.50. In much of Du Pont's litera-

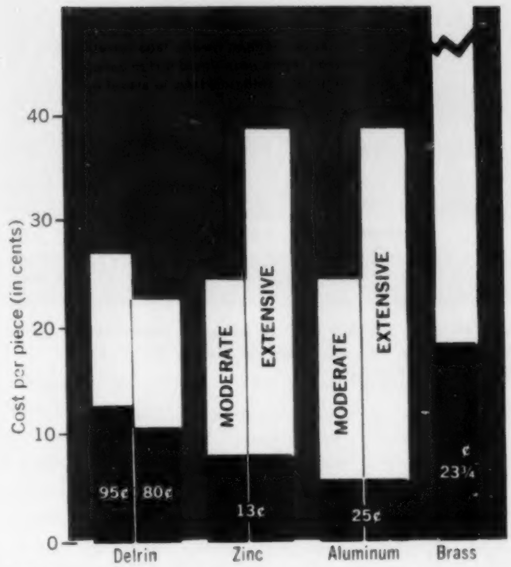


FIG. 1: Estimated purchase prices for a typical industrial part made from various materials. Prices of 95¢ and 80¢ per lb. have been used in this study to calculate the material cost of Delrin. Higher price is the introductory market price; 80¢ figure (not a price forecast) is used to show the effect of material cost on part price. See full discussion in text at left.

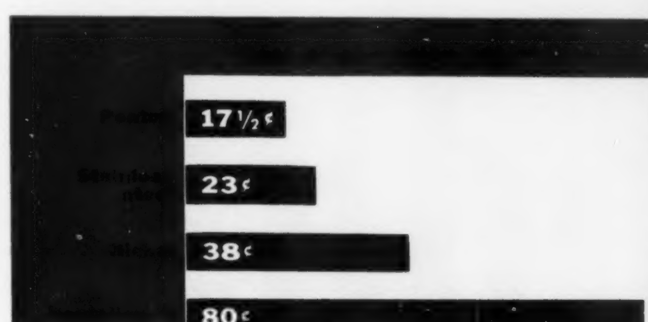


Fig. 2: Sales price per cu. in. of Penton, as compared with three metals.

Mill cost comparison of a Penton valve vs. metal alloy valves
(Based on fabricating a pound of Penton)

	PENTON	STAINLESS 316	HASTELLOY C
Cost per pound	$3.50	$ 0.80	$ 2.00
Correction for density	3.50	4.60	13.00
Waste in fabrication	0	0.70	1.95
Labor and machinery	0	3.45	6.50
Molding	1.00	0	0
Total	$4.50	$8.75	$21.45

FIG. 3: Cost of a molded Penton valve in comparison with stainless steel and Hastelloy C valves. Valve cost based on 1 lb. of Penton.

ture, one can also see an 80¢/lb. figure being used to illustrate just what percentage of the part price is influenced by raw materials cost, just as General Electric talks about a $1 to $1.50/lb. range when full-scale production is achieved. Both figures, of course, cannot by any means be construed as a price forecast—but one can't help noticing.

A host of useful properties

Cost alone, however, has not been the only reason for industry's interest in the three new materials. Approaching as they do the properties of the thermosets, Delrin, Lexan, and Penton all offer a high magnitude of impact strength, heat resistance, corrosion resistance, electrical properties, and dimensional stability.

It would be well to note that while there is a possibility the three may conceivably compete for the same type of application, in all likelihood they will each be going after markets of their own making—with probably a minimum of overlap. Nor does it even seem fair at this stage of the game to try to give them a definitive spot in the family of plastics. Much has been written about Delrin as a "nylon-like material" or Penton as "falling in the area between the fluorocarbons and rigid vinyl." The more one studies the situation, however, the more one realizes how much such comparisons can throw you off. Each of the new plastics is a specific engineering material in its own right—with its own special combination of physical, mechanical, and electrical properties . . . and its own special markets.

FIG. 4: Raw material costs for Lexan vs. six metals, based on introductory price of $2.50 per pound.

Delrin acetal resins

Delrin, for one, is described as "a new thermoplastic engineering material with a combination of properties not found in any other single material." And already available from Du Pont are a number of case studies in which the following different combinations come into play.

1) Impellers and other components for domestic water pumps, which must retain high strength and stiffness on continuous exposure to water, can take full advantage of the combination of low moisture absorption and high strength and stiffness of the resin.

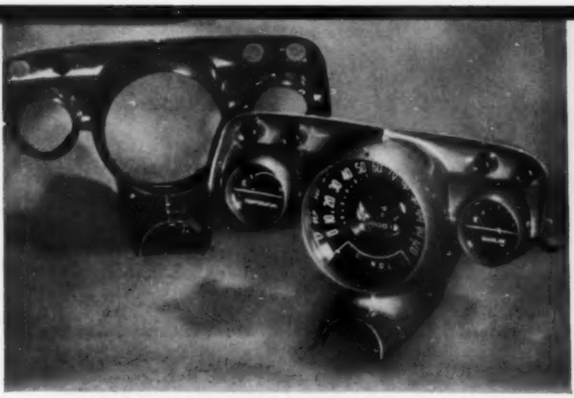
2) Floor truck casters for industry, molded of Delrin, have demonstrated such low creep—deformation under load—that a weight of 300 lb. on each wheel failed to flatten them, even after prolonged standing. Pipe plugs exhibited this same low creep property by holding a pressure of 500 p.s.i. for 150 hr. at temperatures of about 250° F.

3) The high strength, stiffness, and resiliency, with excellent frictional characteristics, are properties which permit acetal resin to be used in zippers.

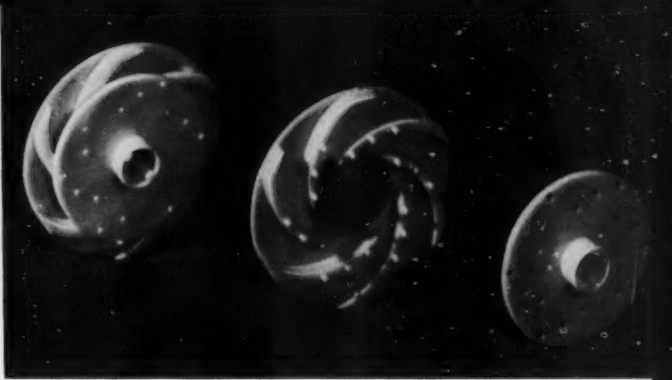
4) Instrument clusters for automobiles are almost 80% lighter in weight than zinc, which is normally used, and thereby offers a reduction in shipping cost and ease of handling during assembly. The ability to hold self-tapping screws without subsequent loosening due to creep or stripping is very important in this application.

5) In applications involving friction, e.g. table-top conveyors and lawn mower and push cart wheels, the molded acetal part can be made to serve as its own bearing.

These applications, of course, are only intended to indicate the versatility of the plastic. They by no means exhaust its possibilities. Already close to 100 molds have been cut specifi-



AUTOMOBILE INSTRUMENT panel is one of many uses for Delrin. It is 80% lighter than zinc and securely holds self-tapping screws.



WATER PUMP PARTS (center and right) molded of Delrin are assembled (left) by using heating tool that swages heads on molded-in prongs.

cally for parts to be molded of acetal and there is talk that these parts may include such items as springs and couplings, typewriter keys, appliance handles, showerheads, blow molded aerosols, sleeve bearings, push-pull cable casings, plugs, carburetor parts, gears—and on and on and on!

Lexan polycarbonate resins

Similarly, Lexan bears the description of "an unusual chemical composition offering a combination of toughness and heat stability not previously available in thermoplastics materials." Its major market areas cover the electrical and electronic, automotive, business machines, aircraft, and military fields and include such items as: coil forms, insulating parts, decorative and functional appliance parts, automotive parts, housings, optical parts, electrical parts, cams, handles, electronic parts, battery cases, etc.—and the case studies that General Electric has to offer show a diversification similar to that of Delrin:

1) For a camera cam that must maintain its dimensions within very close tolerances in order to function properly, Lexan offers the precision molding, dimensional stability and wear properties required.

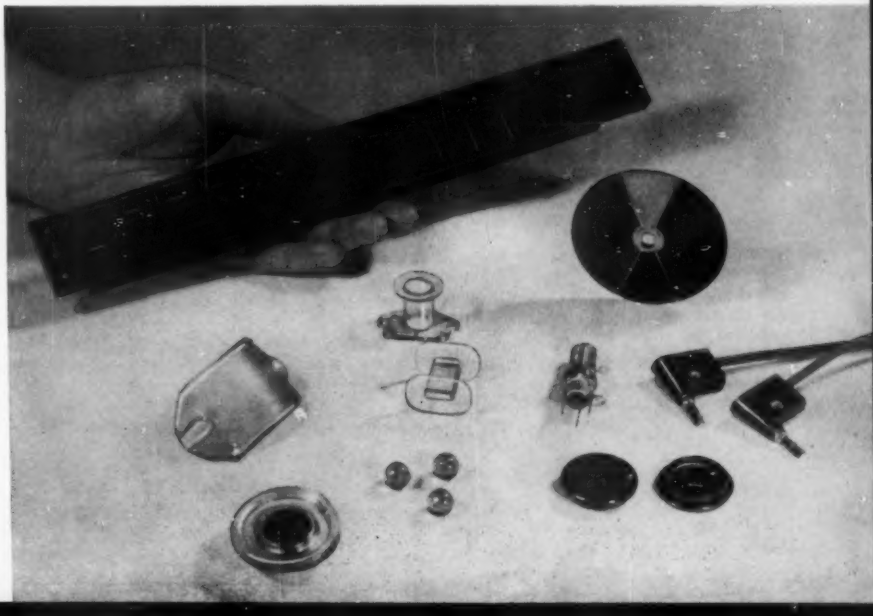
2) The heat resistance of the polycarbonate combined with its transparency made it useful for molding a control disk, with four painted color sections, that had to function at temperatures up to 240° F.

3) Transparent oil bonnets molded of Lexan are used as sight windows in hydraulic circulating oil systems. The bonnets must be unaffected by lubricating oil and, at the same time, must withstand 1500 p.s.i. line pressure plus a 2X safety factor without deformation or leakage at the seal.

4) For coil form applications, Lexan offers heat distortion temperatures of 280 to 290° F. under load, resistance to oxidation at high temperatures, and resistance to corrosion even when it is used with very fine Class F magnet wire.

5) The excellent creep properties of the polycarbonate made it ideal for (To page 173)

THESE PARTS, including a lampholder terminal block, coil forms, camera cam, light diffuser for aircraft instruments, control disk, lens caps, and electrical connectors, are typical of applications now being molded of Lexan.



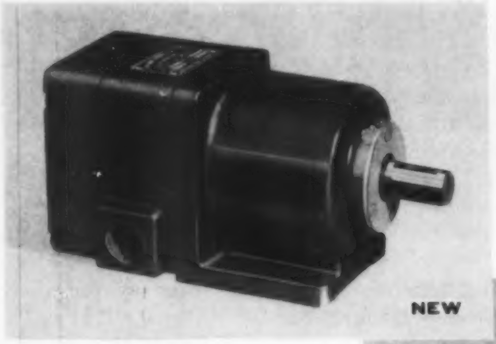
Premix makes a better switch

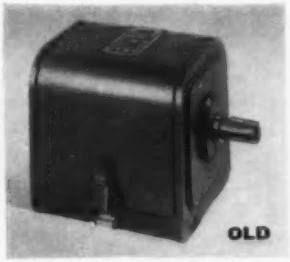
Improved design features are incorporated in safety devices without increase in cost, thanks to economies of polyester molding compound

Mechanical redesign, plus the adoption of housings molded from glass-reinforced polyester, enabled Euclid Electric & Mfg. Co., Madison, Ohio, to develop two new lines of speed-responsive switches more compact, versatile and maintenance-free than their predecessors. Along with these advantages, Euclid reaped substantial savings in time and dollars. By using molded polyester parts, they were able to put the new switch into production with a saving of four months in development work, and at the same time save $15,000 in model and die costs. Furthermore, because of assembly simplifications made possible by integrating many previously hand-assembled details into the premix parts, Euclid is already achieving significant production economies on the unit cost of the new switch compared with the old. With this reduction in costs, Euclid has been able to incorporate several outstanding new features in the new line, including a ball bearing suspension system, without raising the selling price of the switch. Heretofore, these features were not economically practical.

The parts are molded by Carl Zehr, Inc., Ashtabula, Ohio, from Thermaflow glass reinforced polyester molding compound manufactured by Atlas Powder Co., Wilmington, Del.

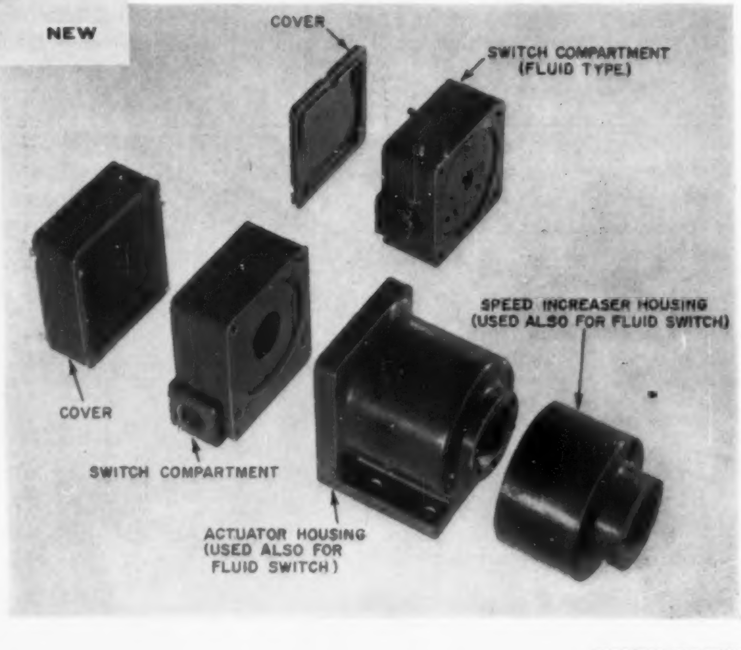
The use of polyester for the switch housings led directly to improving the (To page 179)





OLD SWITCH was assembled in cast iron housing, which was susceptible to corrosion and chemical fumes. Detachable cover could not adequately protect internal mechanism of the older model from contamination.

REDESIGNED SWITCH has premix housing. More efficient flyweight, sealed actuator housing, and dielectric properties of housing, combine to permit more compact unit. Height and width for new part are one-third less than in old switch.



MOLDED PREMIX housing parts for centrifugal (foreground) and fluid-type speed-responsive switches. Housings for actuator and speed increaser assemblies are interchangeable.

THE COVER: Handsomely styled and decorated bottles of blow molded high-density PE for Armour's light-duty detergent point up the design potential inherent in the material. On a price basis, these bottles have now become competitive with metal cans. Both Phillips- and Ziegler-type resins are involved.

New champ of detergent bottles: high-density PE

In a major market revolution, blow molded high-density PE bottles are now being specified by leading detergent makers to replace metal cans. Here's the story behind this breakthrough

The switch to blow molded high-density polyethylene bottles for liquid detergents is now a reality. After several years of test marketing, major detergent producers are now packaging the product in the plastic bottle for national distribution.

For the time being, only light-duty liquid detergents are involved (Chiffon, Joy, Ivory Liquid, Lux Liquid, Swan, Trend, and possibly Vel). Heavy-duty products, such as Wisk, and all-purpose detergents, such as Mr. Clean, Lestoil, Handy Andy, have not yet entered the picture. But some may be expected to, where their chemical content permits.

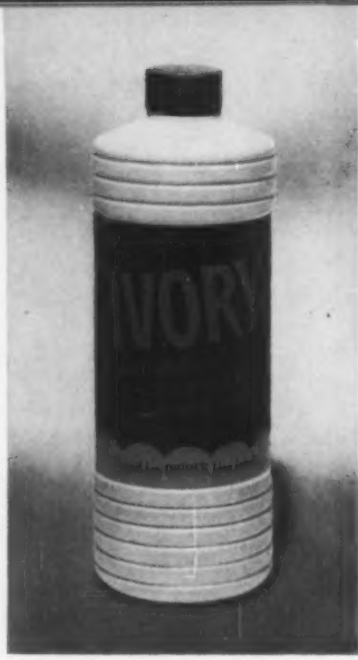
Leading the present drive are Procter & Gamble, Lever Bros., Purex, and Armour. P & G (Ivory Liquid, Joy) accounts for about 20% of the market; Lever Bros. (Lux and Swan) for about 36; Purex (Trend) is third with about 8%, followed by Armour (Chiffon) with five. Colgate (Vel) and several smaller manufacturers are also expected to follow shortly. This expectation is based on price and property factors which put PE in a very attractive competitive position. The material against which PE is competing here is, principally, steel. Almost all light-duty liquid detergents today are packaged in coated steel cans.

The size of the market

Sales of liquid detergents today are at an annual rate of 400 million cans. In terms of volume potential for PE, this represents about 40 million lb., based on an average weight of $\frac{1}{10}$ lb. per bottle. The three sizes of PE bottles for this application tip the scale as follows:

12 oz. . . . . 30 grams
22 oz. . . . . 45 grams
32 oz. . . . . 55 grams

One material maker, taking into account the increasing rate of growth of liquid detergents,



SAMPLE MOLDING for Procter & Gamble's Ivory Liquid. Considerable design work is currently in progress, and no one knows at this moment exactly what the final design of the bottle will look like.

AN EARLY DESIGN for a Lever Bros. Swan bottle. Both the detergent and the bottle have been in market test areas for some time. It is likely that there will be some redesign on this container before it hits the national market, but exactly what it will be cannot be determined at the present time.

estimates the 1960 market potential in the neighborhood of 50 million lb., and the 1965 requirements at a whopping 120,000,000. And these were termed "conservative estimates." It is generally felt that once the position of blow molded high-density PE has been established in this field, other products are sure to follow. For example, bleach is considered a good candidate.

Who is in the picture?

The story starts almost three years ago when Hercules Powder Co. and three bottle blowers set up a development program based on Ziegler-type Hi-fax 1600-E, which proved to be the first material with enough stress-crack resistance for the job.

Market testing was a long drawn-out affair because the market loomed so large no one could afford to take any chances on failure. Containers were redesigned time and again, molds were built and rebuilt, blowing techniques were revised, cartoning had to be reengineered, filling equipment had to be developed and built.

With thousands of packages out for field test for two full years under all possible conditions of punishment, it is worthy of note that not a single failure was reported in bottles made of Hi-fax 1600-E.

Five blow molding companies are currently supplying all the bottles for the liquid detergent field: Plax, Owens-Illinois, Continental Can, Royal Mfg. Co., and Imco. Rumors in the field have it that a sixth company will soon enter the picture. This is a supplier of metal cans who is trying to adjust to the changing market pattern. All blow molders have been adding machines, often of improved design, to increase their capacity to meet the new demands.

As to resins, almost all producers of high-density material are competing for this market. Originally only Ziegler-type resins had been found suitable for this application. With the recent introduction of ethylene-butene copolymers, Phillips-type material, Marlex 5000, is in the picture, too. The various resin suppliers and what they are offering are listed in Table I, p. 75.

The economics of PE bottles

There are several reasons why PE bottles have penetrated the field of liquid detergents: they can be designed in more consumer-appealing shapes. They resist denting. They will not rust. They do not leak. They are more easily handled. Color can be molded in. And many more. All these reasons are important; but, according to a spokesman for one of the molders, the thing that counts most is the prospect of important cost savings in the future.

Neither molders nor soap makers will release any precise cost figures. Certain rules of thumb, however, have been established. For example, one resin supplier asserts that PE bottles, generally speaking, cost less than metal ones in the 12-oz. size, are about the same in the 22-oz. category, and come slightly higher in the 32-oz. size. A more precise figure, sug-

gested by one of the molders, establishes the cost (undecorated) at 1.9 times the material. This method of cost determination results in figures that may be higher than metal cans.

However, detergent makers are aware of two important facts: steel prices are headed up (despite two recent cuts in can prices), while PE prices are expected to remain at present levels, or even go lower; and improvement in molding machinery and techniques is such that per-piece cost will certainly go down. Reports have been heard concerning the development of a European machine that cycles at the speed of glass blowing equipment. If confirmed, the effect on the price structure of PE bottles should be strongly felt. Apparently, detergent makers fully expect this development to take place. Their packaging commitments have generally a two-year lead time. They make decisions in anticipation of future price movements. Thus, we may expect their products to be fully packaged in PE by 1961. In the meantime, they have sizable inventories of metal cans to dispose of.

To understand the economics of blow molded high-density PE bottles for detergents, one can analyze the factors that go to make up the final cost of a hypothetical bottle and compare the resultant price with that of a metal can. That price will not refer to any particular bottle—too many variables are involved. It will be sufficiently close, however, to serve as a valid basis for comparison.

Typical quotations for metal cans, as delivered to the soap manufacturer, are:

12 oz.	$58/1000
22 oz.	$75/1000
32 oz.	$86/1000

These prices are for large-volume orders and cover lithographed cans with closure, delivered to the soap manufacturer ready for filling.

While cost estimates from bottle makers vary widely because of their different methods of casting, here is one analysis, based on the 22-oz. size:

Material (natural)	3.8¢
Colorant	0.2
Machine time	1.0
Decorating	0.6
Packing	1.0
Closure, profit, etc.	0.8
	7.4¢

And here is one from another source:

Colored material	4.2¢
Machine time	1.0
Decorating	0.8
Packaging and shipping	1.4
Overhead, profit, etc.	1.4
	8.8¢

(Note—in this case closures sold separately.)

The material figure represents 1/10 lb. of natural virgin resin (45 g.) at 38¢/pound.

Machine charges and cycle times are not yet available from molders. Based on accepted practice, however, a charge of $12 per machine hours is a reasonable figure. Also reasonable is a 3-sec. cycle, or 20 bottles per minute on a multi-mold machine. Machine time is assumed to include all depreciation and overhead costs; decorating is generally silk-screening or applied paper or foil labels. Less expensive printing methods are being investigated.

Because of special requirements, there are makers today who pay a premium for the use of PE bottles in all sizes. But as mentioned earlier, these companies project price over a two-year period, during which (To page 180)

Table I: Resins available for detergent bottles

Company	*Designation*	*Type*[a]	*Density*	*Melt index*
Celanese	Fortiflex B-50-20	C	0.950	0.2
W. R. Grace & Co.	Grex 50-004-C	C	0.950	0.4
Hercules	Hi-fax 1600-E	Z	0.945	0.2
Koppers	Super Dylan 6002B	Z	0.953	0.2
Phillips	Marlex 5000	C	0.950	0.2-0.3
Union Carbide	DMD 3005	Z	0.947	0.2-0.3

[a]C = copolymer, Phillips type
Z = Ziegler type

FACTORY WASHROOM has concrete block walls faced with sprayed on polyester. Chemical resistant coating is approximately 20 times the thickness of the average 2-coat paint film.

OPERATOR SPRAYS polyester coat on inside surface of plant wall. Only standard spray equipment is required.

New tool for builders: spray-on polyester

Based on 100% reactive resin, coating imparts decorative face to concrete blocks and other surfaces—on site

The economies available to builders through the use of factory-made polyester-faced concrete blocks (see "How builders can profit with polyester-faced concrete," MPl, May 1959, p. 102) have now been extended to architectural and industrial maintenance coatings. The case in point is Glid-Tile, a 100% reactive polyester resin that sets up to a hard chemical-resistant finish, produced by The Glidden Co., Cleveland, Ohio.

Material cost for a 20-mil film thickness is 13¢ to 15¢/sq. ft., depending on type of decorative effect employed. This cost rises proportionately with film thickness. A 30-mil film, for example, would cost 50% more. Applied cost varies throughout the country in accordance with labor cost.

According to John Lawrence, Polyester Project Coordinator of Glidden's Paint Div., the resin in Glid-Tile sets in about 1½ hours. A tack free condition develops in around 4 hr., and complete hardness in 16. The material air-dries and no heat is involved during cure. Application is by standard techniques, preferably spraygun.

What are the advantages?

Because of its good chemical resistance, the system is particularly recommended for industrial application, both new construction and maintenance, with masonry block surfaces constituting the greatest market. Current formulations are not intended for exterior use. However, a company spokesman states that "research work is now being carried forward to develop a formulation for outdoor exposure."

The following are the major advantages claimed for the system over prepared polyester-faced concrete blocks: 1) A variety of colors and decorative effects is available; color choices can be made on the spot; 2) No special processing equipment is needed; 3) There is no problem of rejects, since the coating is applied to a finished wall.—End

Helmet, with liner of expandable styrene and outer shell of reinforced polyester, effectively absorbs severest shocks

Crash cap for cops

HELMET of motorcycle patrolman engaged in typical pursuit consists of RP outer shell, molded expandable styrene liner.

Low-cost insurance against serious head injuries is afforded by a new crash helmet whose reinforced plastics shell is lined by a molded expandable styrene "cushion." At least half a dozen U.S. cities have adopted the heavy-duty model for their motorcycle patrolmen; a lighter version for squad-car and foot police is in the works. The former sell for $29.75 each, the light-weight type for $19.75.

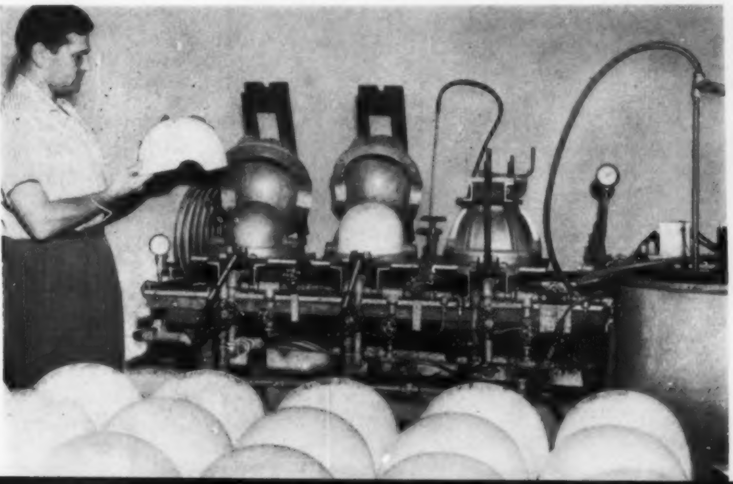
The exceptional protection given by this new type of headgear is to a large extent due the liner. In a report on safety helmet tests conducted at the Sacramento, Calif. County Hospital, the expandable styrene liner was the only one listed as "excellent." According to the tests, this liner absorbs shock force and decelerates high-velocity impact to a fraction of its original intensity *before* it reaches the head.

Complete heavy-duty helmets weigh 24 oz.; the general-duty units weigh 18 ounces. Average weight of the liners, made in three sizes, is 3 ounces. A removable sweatband will yield under impact, allowing the head to cradle into the protective shock-absorbing liner.

The new helmets are being produced by Toptex, Inc., Inglewood, Calif., using reinforced plastics outer shells manufactured by Fiber-Resin Corp., Burbank, Calif., and expandable styrene liners molded by Zant and Assocs., North Hollywood, Calif., of Koppers material. Manufactured to close tolerances, the liners are held securely in the shell by a double-faced pressure-sensitive adhesive tape.

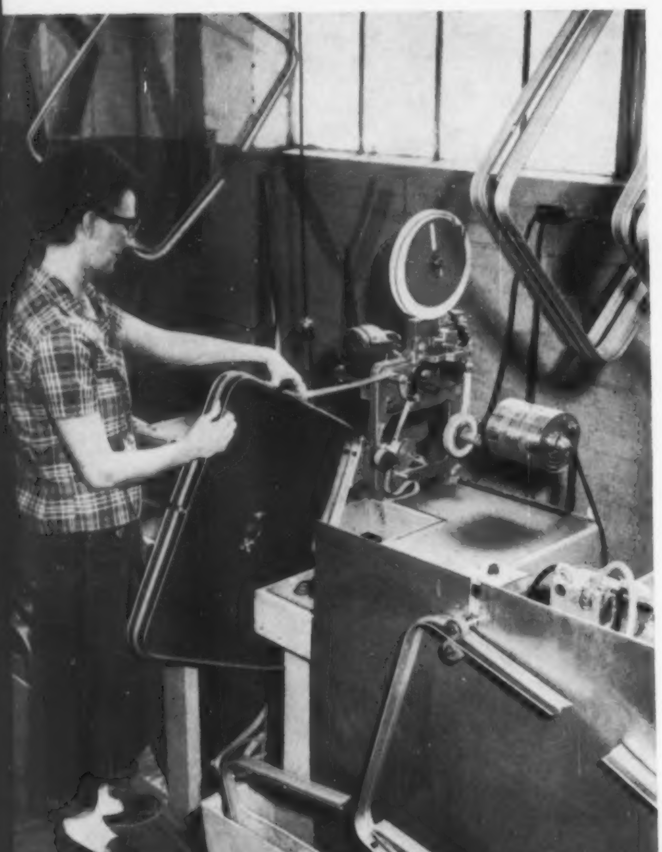
The outer helmet shells are produced by spraying a 50: 50 ratio of resin and fibrous glass simultaneously into metal molds, using a Twin-Tip spray gun with Glass-Hog attachment manufactured by Peterson Spray Gun Co., Inc., San Mateo, Calif. High-viscosity isophthalic resin, specially formulated by Fiber-Resin for spray gun application, gives physical properties to the finished molded laminate, which are claimed to approach closely those attainable with the more costly epoxies.—End

MOLDING of expandable styrene helmet liners is accomplished in hinged steam-heated metal molds.



Vinyl luggage trimmed faster

Double-coated tape and ingenious laminating equipment cut cost by 50%, double production, and reduce rejects for major luggage maker



LAMINATED STRIP of tape and vinyl is applied to the center frame of a Samsonite Silhouette case. After application, the trim is placed between the rollers at the side of the taping station for further pressing. The frame is then attached to the case, which is conveyed to another station for trimming of the side tracks.

Production has been doubled, costs trimmed 50%, and clean-up problems eliminated at Shwayder Bros., Inc., Denver, Colo., since the adoption of double-coated tape to hold vinyl trim strips on the firm's new line of Samsonite Silhouette luggage. In addition, uniform trimming results have been achieved and rejects due to costly clean-up operations are now a thing of the past.

Now, up to 42 cases an hour can be trimmed by each worker—as compared to the maximum 20-per-hour speed of the previous method—according to Morton Rechnitz, assistant to the production manager. About 2650 cases are trimmed during the two daily 8-hr. shifts.

Prior to using the tape, pre-cut strips of vinyl trim were applied manually over brushed-on adhesive. At least three persons were needed to clean the oozing residue from the finished cases. The new method, by doing away with this necessity, released some of the employees from the assembly line for other important work in the plant.

Now, much of the trimming work has been replaced by nine laminating machines that automatically combine continuous lengths of vinyl trim and double-coated tape. The machines, designed by Minnesota Mining & Mfg. Co., are called Scotch brand K-134 laminators, and can laminate up to 80 ft. of tape and trim a minute.

The trim, once it is laminated, is adhered to magnesium tracks—or grooves—of the case either manually or semi-automatically. The semi-automatic application is accomplished at six of the nine application stations. Each station is manned by one piece-work employee.

The type of application depends on whether the tape-vinyl strip is dispensed by hand or by mechanical rotation of the case, Rechnitz said.

Steps in applying tape

The manual application—the first step in the trimming operations—can be accomplished with a hand-rotated jig in about 10 seconds.

This rotation dispenses the tape-vinyl strip as the operator applies the trim to the track of the center frame of the case. The frame, secured on the jig, is rotated counter-clockwise and as slow as desired for accuracy. A gap in the middle of the frame top prevents a com-

for less

plete revolution of trim and allows for the installation of the case's recessed locks.

The trimmed frame, after being placed between two automatic rollers for further pressing of the trim, is attached to the rest of the case and conveyed to one of the six semi-automatic stations for trimming of the case's two side tracks.

The semi-automatic application—the second trimming step—can be accomplished in 6 sec. with air-operated pads, which automatically rotate the case as the side trim is applied with a mechanical guide arm.

The laminating machines are turned on by the initial pulling of the strip, which flicks a switch inside the laminators. The switch automatically flicks off when the laminating action becomes as fast as the dispensing action. The speed of the machine depends on how constant the dispensing action is.

The tape—Scotch brand double-coated tape No. 400—comes in 108-yd. rolls for the trimming operation, and consists of adhesive coated tissue paper considered capable of holding 65 lb. per in. of its width.

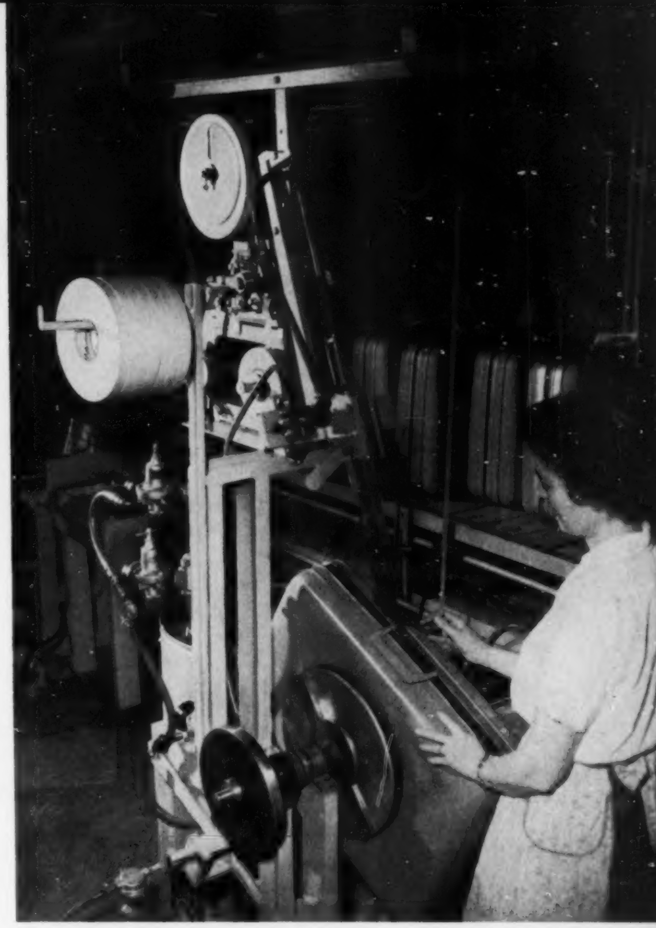
The tape's crepe-paper liner is removed automatically by the laminators and discarded in a trash container during the lamination.

When both side tracks are trimmed, the case is conveyed to an inspection station, where polished metal clamps are placed over the mid-section of the bottom of the case. And after one inspection, the cases are conveyed to the shipping department. No extra trimming inspection is needed. Previously, at least two extra inspectors were required to examine the cases for possible trimming defects.

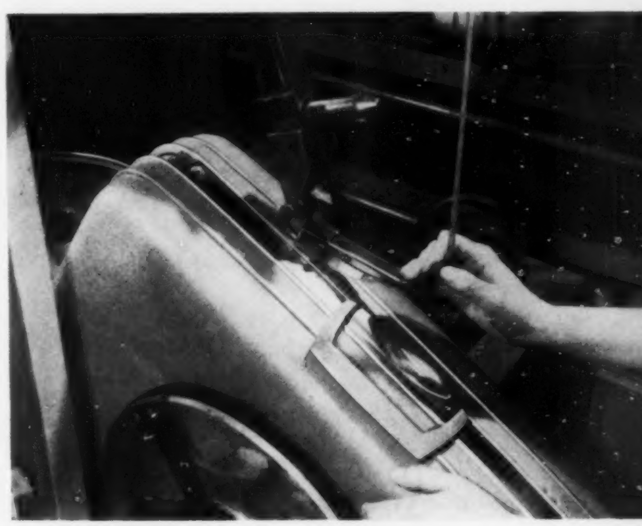
The new method is used on the complete Samsonite Silhouette line, Rechnitz pointed out. The line is considered to be Shwayder's finest, and includes eight different types of cases, ranging from women's variety cases to men's three-suiters. The application can adjust to any shape and size.

The method was installed last November in about seven days. Some of the equipment used for the previous method was easily converted for the new use, according to Shwayder.

It is expected that this tape application will find additional use in other vinyl end-use industries.—End



TWO SPONGE-RUBBER PADS clamp case in place and rotate it while the side trim is semi-automatically applied. The strip is dispensed by the rotating case and applied through the head of the mechanical guide arm secured in the side track (see close-up, below). Operator controls the rotation with finger-tip pressure. Foot levers are pressed to activate the pads, which revolve the case almost a full revolution in 6 seconds. The rotation stops when the operator releases one of the levers.



Formed portable altars

Three different forming methods are used in making parts for unusual product

FOR USE BY MILITARY, conventional looking "travel case" opens up to versatile altar. Top photo shows cases stocked for Christian (left) and Jewish services. Bottom left shows case with folding altar table attached. At right is altar, covered and ready for use.

Chaplains of all the Armed Services had a common problem: the heavy weight, large size and lack of durability of their portable altars, which were leatherette-covered wood cases. Furthermore, there were different designs for the various religions, which was an unnecessary expense.

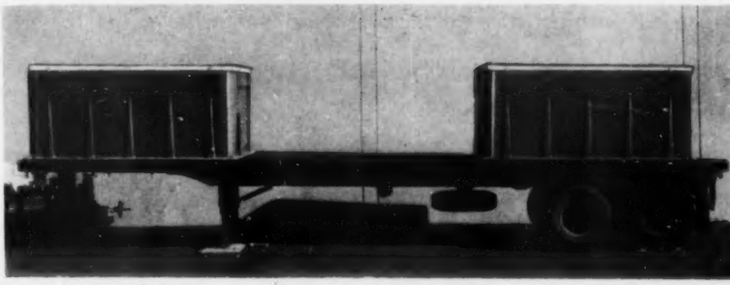
The problem was solved by Halsen Manufacturing Co., Philadelphia, Pa., by thermoforming black Royalite ABS sheet, grained on one side, to a simple but compact design.

Each altar is composed of three parts: the outer shell or case, drape formed using the snap-back method; the nest for the vessels, drape formed using plug-and-ring technique; and the folding altar table, a straight vacuum forming job. One basic design serves for all religions.

These altars are no more expensive than the wooden ones, weigh 5 lb. less, are one-third smaller in size, and they stand up to air travel abuse and to service from the Arctic to the tropics.—End

OLD DRY ICE CONTAINER is essentially a wooden structure. To achieve proper insulation in this model, walls are filled with 8 in. of mineral or conventional glass insulation.

NEW reinforced plastics container requires less space for significantly better insulation. Both reinforced plastics skins and urethane foam insulation contribute to this increased insulation efficiency.



Payload upped 3840 pounds!

Reinforced plastics container replaces wooden structure in dry ice transportation at impressive weight savings; cuts down on ice sublimation, too

Significant advances in the shipment and storage of dry ice have been brought about by the development of molded reinforced plastics containers that replace wooden structures previously used. Designed by Odyssey Trailer Co., Santa Ana, Calif., in cooperation with Cardox Corp., the containers have resulted in a 3840-lb. increase in legal payload, a 704-lb. decrease in dry ice sublimation, and the achievement of a weight efficiency factor (weight of contents divided by weight of container) of 93.4 percent.

The containers are now produced in a variety of sizes. Costs vary; the containers shown in the accompanying illustration cost $4700 each. This figure includes special mounting on customer's trailer and engineering services to locate the containers for optimum weight distribution and maximum legal payload. Today's cost of the wood model, above, is about $8000.

How they are made

The containers are produced of glass reinforced polyester. Woven roving, made from Johns-Manville's Garan roving, is supplied by Thalco Glass Fiber Products, Los Angeles, Calif. Plaskon PE 169 (Allied Chemical) is the polyester used. Molding is by hand layup contact pressure.

The containers are assembled in panels with reinforced plastics structural members separating the inner and outer skins. After the panels are assembled, polyether foam insulation is expanded in place between the skins. Polytron Corp., Berkeley, Calif., supplies the polyether resin.

Because of the insulating qualities of both the reinforced plastics structures and the foam, it was possible to reduce wall thickness to less than half over the wooden construction—which had 8 in. of conventional glass or mineral wool insulation in the walls. Container lids have paper honeycomb cores with woven roving reinforced laminates on both sides.

According to Odyssey spokesmen, suitable adaptations of the basic design can be used for transporting and storing frozen foods and industrial and military chemicals; packaging of electronic equipment and missile components; and transporting or storing of equipment and materials requiring flotation as well as temperature and moisture control.—End

*5, *6, *7 in a series

EVERYBODY NEEDS EPOXIES

Second group of a series of articles on epoxies gives the reasons why our fastest growing industries enthusiastically accept these versatile resins for prototypes and production runs. First group of articles (July issue) discussed the main types of epoxy coatings

VACUUM FORMING TOOL for polyester radome is a laminate of fibrous glass cloth and epoxy resin, held rigid with 1¾-in. fibrous glass tubing and ¼-in. Masonite headers, cemented in position with epoxy putty. Polyester part is formed on this tool by the wet layup process.

Forming tools made faster for less

By John Delmonte*

The versatility of epoxy plastics has been demonstrated quite convincingly in the fabrication of forming tools. Requirements for materials may vary from high impact strength, semi-resilient epoxies to the more rigid, heat resistant compounds for high temperature forming. The preparation of epoxy forming tools is generally motivated by the need for early production and the cost savings that would be achieved through the elimination of expensive machining operations.

Many hundreds of epoxy forming tools are in use at automotive, aircraft, missile, machine shop, and metal fabricating establishments throughout the country. Some epoxy tools are designed for limited productions of less than 50 units, while other epoxy forming tools have turned out thousands of parts. To realize maximum advantages, the leading tool establishments rely upon the services of epoxy resin formulators specializing in tooling materials. This group of manufacturers, known as the Epoxy Resin Formulators Division of The Society of the Plastics Industry, Inc., is participating in the establishment of standards, test methods, and quality control to insure acceptance of epoxies by tool builders.

*Gen. Mgr., Furane Plastics, Inc., Los Angeles, Calif.

There are several ways of classifying epoxy forming tools, the most convenient by the functions accomplished and the other by the construction method for the tool. Both classification schemes are shown below.

Functional classification

Metal forming tools. The forming of sheet metal may be accompanied by drawing of the metal. The latter operation imposes severe

stresses on the epoxy, which may require a metal strip reinforcement or the dense and close packing of metal fibers on the draw radii. The success depends upon the design and planning of the draw die.

For simpler bends and draws, such as the beading of aluminum panels for stiffening purposes, the high impact, epoxy-capped tools of the aircraft industry are successful.

Metal bonding tools. Laminated epoxy tools by the hundreds have been built for the assembling and bonding of metal components. Because of the necessity of curing temperatures up to 350° F., heat resistant epoxies have been used in conjunction with glass cloth. These tools possess high accuracy and dimensional stability.

Vacuum forming tools. Both laminated and cast epoxies have been specifically formulated for vacuum forming tools, operating at temperatures up to 300° F. Thermoplastic sheets are formed in such tools on production basis or vacuum bag techniques are used to cure pre-impregnated glass fibers.

Molding dies. A more recent development of significance to the plastics industry is the preparation of compression, transfer, or injection molding dies from epoxies. Polyester or phenolic or thermoplastic compounds are usually molded under heat and pressure in high temperature resistant epoxy dies. The dies are not only formulated from heat resistant epoxies, but they will also use a large quantity of special high conductivity core materials to assist heat transfer form the platens of the molding press.

A more complete understanding of epoxy forming tools may be gleaned from a comparison of their construction features. These details are emphasized in the following classification schemes.

Construction classification

Rough metal castings capped with epoxy. In an effort to reduce the amount of plastic required and to lend added strength to the construction, rough metal castings of Kirksite or of aluminum are positioned with respect to an accurate plaster pattern, and a tough epoxy capping poured net to size. Many costly machining hours are obviated. In an epoxy forming tool of this character, particular attention must be given to the proper adhesion of the epoxy to the metal core and the introduction of sufficient resiliency to accommodate differences in thermal expansion. High impact loads may impose severe stresses and limit the service life of these tools.

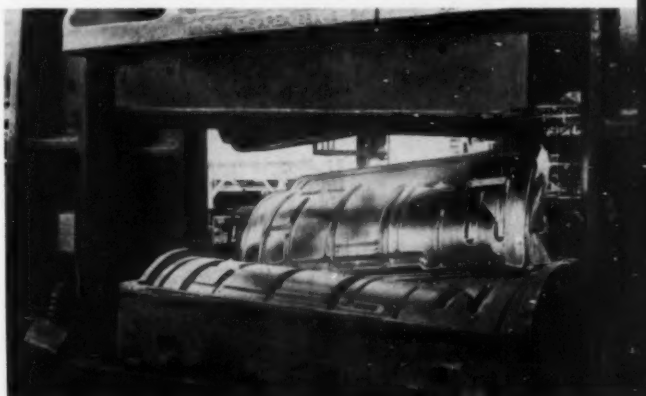
Because of their stiffness and stability, laminated epoxies may also serve as vacuum forming tools, access to the source of vacuum being obtained by drilling through the skin. If greater stiffness is required the laminate may be backed up with a semi-porous core and epoxy resin binder.

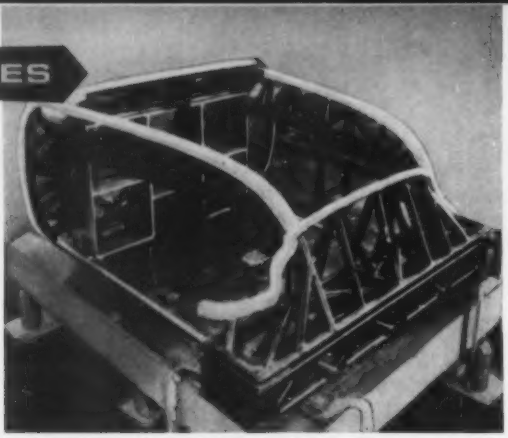
All plastic impact tools. A typical development in high impact all plastics tools is fabricated from an abrasion resistant face coating, a laminated fibrous glass back-up, and a core of a mass casting epoxy. This tool shows promise for setting radii of steel metal stampings or for impact forming of softer sheet metals. The ability to pour unlimited volumes of epoxy casting resins capable of curing at room temperatures, makes this type of tool feasible.

Cast tools. Where the utmost in dimensional stability is not required, an epoxy tool—such as a hammerhead—may be cast in one piece without additional fabricating operations. This hammer may be used to hand-form sheet metal or break-up concrete, and demonstrates quite convincingly the toughness of the epoxy. In automotive practice, cast all-epoxy tools are used in the early hand-forming of prototype body parts. They are generally cast against an accurate model.

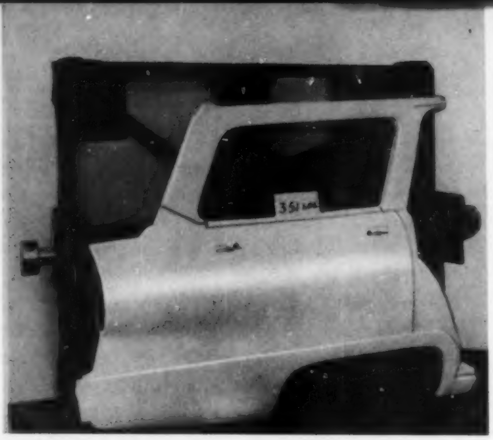
Epoxy forming tools require all the skills and resources of an experienced epoxy resin formulator. They may be resilient or very hard and abrasion resistant, depending upon the construction. In either event, their widespread acceptance for so many functions attests to their versatility.—**End**

EPOXY-FACED drop-hammer die (foreground) used for forming sheet aluminum aircraft part (rear) shown being removed. Epoxy face has high impact strength, yet is resilient enough to accommodate thickness of most gages of aluminum and thinner steels.





AUTOMOTIVE INDUSTRY uses fixtures like these to check all front end sheet metal units, including the hood, door details, and cowl, as well as the radiator support detail.



INTRICATE SHAPES such as this quarter panel side assembly welding fixture are easily and quickly obtained with epoxies. This unit weighs 351 lb., compared wth 1264 lb. in steel.

Four ways of building epoxy jigs

By William A. Lawry*

Great strides have been made in recent years in the whole field of plastics jigs and fixtures, and epoxies have outstripped all other materials in these important industrial uses. These resins are fast and easy enough to handle and reduce labor hours substantially. This results in significant savings because up to 95% of tooling costs may be man-hours. Furthermore, the time saved in actual tool building also provides the extra benefit of shortening production schedules.

An estimated 75% of checking fixtures used in the automotive industry are now built of plastics—mainly epoxies. Other industries are beginning to follow suit, with increasing numbers of tools–such as nesting, holding, and engineering fixtures; and assembly jigs—taking advantage of the cost saving potential provided by epoxies, in these "accessory" types of tooling. These fixtures are frequently complicated in design and often require ingenuity and a talent for improvisation.

The technique used in building a jig or fixture depends on many factors, such as dimensional stability, end use, time, labor, etc.

Laminating

From the standpoint of dimensional stability and strength, the laminated fixture is the best type. Practical considerations enter into the design and building of the laminated tool, too. For instance, a holding jig will need considerable strength. Therefore, it may require up to 18 layers (glass cloth and liquid laminating mix alternately applied) to build the tool required. A tool or fixture of 18 layers would be ⅜ in. thick.

A checking fixture would not require the same strength as a holding fixture and a fixture of 8 to 10 layers, or 3/16-in. to ¼-in. thick would suffice. A skin panel could be even thinner, with only 3 or 4 layers and a thickness of perhaps no more than ⅛-inch.

Certain laminated tools require a surface coat for appearance and smoothness, but this coat is neither a preservative nor a hardener.

Casting

In surface casting the tool usually consists of a metallic core which is rough cast to the general shape of the finished tool. The core is suspended over a model of the working face of the tool and liquid plastic is then cast into the space between the model and the metallic core. Mass cast tools usually are made entirely of the plastic material. However, metal inserts sometimes are built into the unit for added strength at certain stress points.

Paste

Because of the outstanding dimensional stability of paste epoxies some tools now are utilizing paste plastics within the laminated portion of the unit. In addition, many pattern shops use paste plastics in small and medium size foundry patterns. The dimensional stability of tools made of paste plastics is slightly less than that of laminated tools; however this stability is well within the working tolerances

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that are generally encountered in the metalworking industry.

Some types of holding fixtures can be made by the "squash" method with paste plastics. This sacrifices some strength and appearance but it is a faster and a cheaper method, and for certain applications, it would be the proper method to use in terms of time and cost savings. Ready-made paste materials are available, or any of our fluid materials can be used to make a paste by the addition of flock and fibers.

Prototypes

Another important use of epoxy tools is in the building of identical duplicates, or prototypes, for use in various departments of a plant. These prototypes can be made relatively quickly and inexpensively.

The economy, efficiency and ease of application is dramatically demonstrated by this true case history of an automotive manufacturer. The manufacturer needed a set of 12 fixtures, designed in steel with plastic surfaces, for use as masters in making a group of welding fixtures. The cost in steel was quoted at $68,000 with 22 weeks for delivery. The fixtures were made in plastics in 7 weeks at a cost of only $33,000, or saving of more than 50% in cost and almost 70% in delivery time.

Progress has also been made in reducing the cost of the basically less expensive plastics materials. Several years ago a tool built conventionally cost $12,000. In plastic it cost $8000. Today, in epoxies, the same tool costs only $2600. As can be seen, epoxy resins provide another material with which to accomplish new goals in tooling with greater speed and accuracy.—End

Epoxy chosen over aluminum for large sheetforming mold

The problem of exotherm, which frequently poses difficulties in the production of large epoxy pieces, has been successfully overcome by Chanal Plastics, Inc., New York, N. Y., in building three giant vacuum forming molds.

The molds, weighing approximately 300 lb. each, are among the largest all-epoxy sheet forming tools ever produced. Measuring 29¾ by 45 in., with a 9-in. draft, they are used to form one-piece children's wading pools at the rate of 45 per hour.

Several reasons are cited by the company for choosing epoxy over cast aluminum: 1) greater economy of the epoxy resin; 2) high conductivity of aluminum slows the forming cycle; and 3) possibility of overheating the aluminum die and resultant blushing or crazing of the sheet.

The resin used in this application is an aluminum-filled epoxy. The hardener that was selected is said to diminish the exotherm problem by bringing the casting to a "B" or gel stage below the critical temperature. The cure can then be completed at high temperatures without fear of distortion. Resin and hardener are supplied by Smooth-On Mfg. Co., Jersey City, N. J.

After a wooden master pattern has been created, vinyl master sheets are drawn over it. Of these, the one most perfect is selected and a plaster splash made on it to give it necessary rigidity.

Dispensing resin into the mold required four separate pourings at 4-hr. intervals, about 5.5 gal. of resin and hardener being mixed each time. Care had to be taken that the exotherm never went above 150° F., since the vinyl master would distort at that level. Each completed casting was first allowed to cure at room temperature for 24 hr., and the vinyl draw and plaster splash removed. The hardened but still brittle mold was then placed in an oven at 300° F. to complete the cure.—End

PLASTER SPLASH on vinyl skin represents one of the steps in making epoxy vacuum forming mold. After cooling system has been inserted, resin hardener mixture will be poured into it.

TV sets get new look through epoxy

Major design advances in television receivers are expected as a result of a newly developed TV picture tube relying heavily on epoxy resin for its unusual construction. Conventional tubes consist of just a large glass bulb. The set maker generally installs a separate implosion glass in the cabinet, as a rule an inch or so in front of the picture tube. In the new construction, an implosion panel, contoured to the shape of the tube face, is laminated to the tube face with an epoxy resin. The panel was originally developed by Corning Glass Works and is now supplied by Corning and Kimble Glass.

About 1 lb. of resin is used per tube. With an annual production of about 6 million new tubes, the market potential is phenomenal. Such major firms as National Video, RCA, Sylvania, and Westinghouse are reportedly adopting this new tube design, and several 1960 models will feature it.

Why they do it

The laminated picture tube is finding acceptance despite the fact that it increases tube cost to the TV receiver manufacturer by about $5 per set. What does it offer that overcomes this price handicap?

According to John P. Kearny, general manager of Electronic Products Div. of Kimble Glass, the reasons can be summarized as follows:

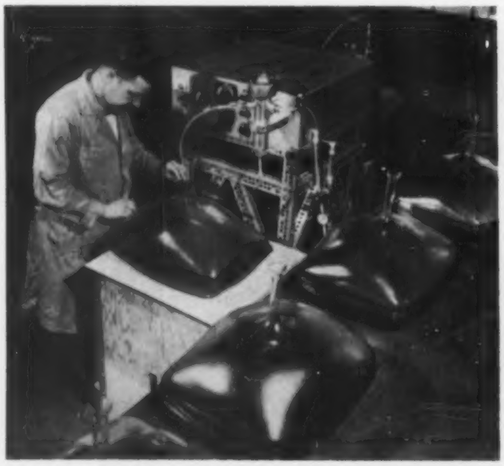
"Set design will be more flexible because of the elimination of the separate plate. In some sets, several inches in depth can be eliminated because the tube does not have to be recessed. Above all, completely new set designs are made possible.

"Another improvement on the new tube is its shape. Much of the rounding has been removed from the corners, producing a more nearly rectangular picture. This will increase the diagonal size of the 21-in. tube to 23 in. and of the 17-in. tube to 18 inches.

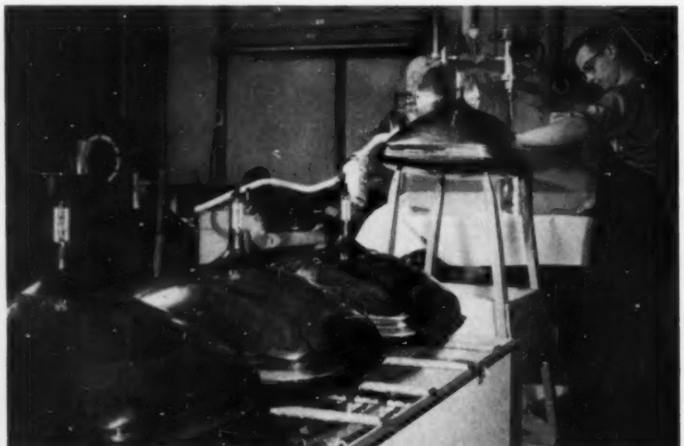
"Picture quality is improved because dust can no longer collect between the picture tube and the safety plate, and because the amount of reflection from outside light sources has been greatly reduced by the elimination of two glass surfaces. Furthermore, since the implosion panel is of uniform thickness throughout, even distribution of light over the entire picture surface is assured."

How the tubes are made

The first resin used by tube makers in commercial production runs is DER 741-A, developed by Dow specifically for this purpose. It is not offered for any other. The requirements which the resin system had to meet were: 1)

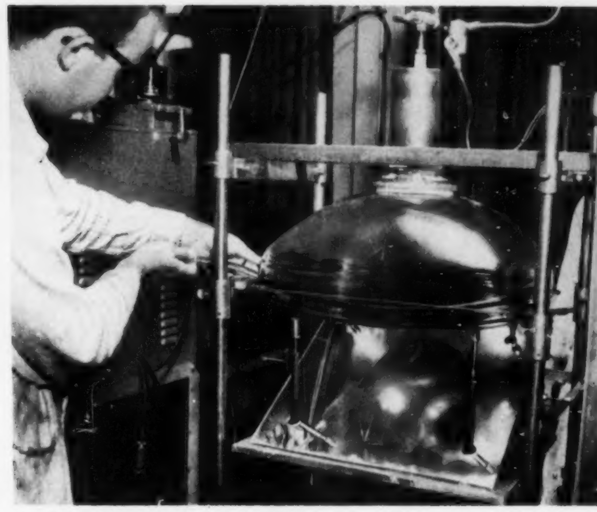


EXPERIMENTAL LAMINATING line at Shell Chemical lab. For dispensing equipment, see opposite page.



LAMINATING IMPLOSION plate to tube, using the Dow system. Tubes in foreground are being preheated prior to lamination.

CLOSE-UP of flat top nozzle dispensing resin into gap between tube and protective glass.



MIRROR MOUNTED underneath tube assembly at dispensing station in Owens-Illinois Technical Center permits immediate inspection, makes possible salvaging of tube before resin has hardened.

adaptability to mass production techniques; 2) transparency and conformity with EIA color standards for television; 3) implosion protection of the laminated assembly and ability to withstand rugged handling; 4) nonsensitivity of the finished tube to extreme humidity and temperature changes; 5) excellent adhesion to glass.

The actual lamination procedure is a six-step operation:

Cleaning: All glass parts must be clean and dust-free; this is generally done by detergent washing, rinsing, and drying.

Panel and tube assembly: The safety panel is secured adjacent to but free from the tube, leaving a minimum space of 60 mils to contain the resin between tube face and implosion plate. Devices to secure this separation (some developed by Dow, some by tube makers) include rubber-protected steel straps and plastic spacers and shims; polyvinylidene chloride shrink film band over tube with temporary spacers (a Dow development); vacuum chucks and others.

Heating: Tubes and panels are heated to 210 to 230° F. to accelerate cure time of resin, using air ovens, infra-red lamps, or radiant heaters.

Dispensing: The spaced, preheated panel and tube assemblies are brought to the dispensing equipment. There the resin-hardener mixture at a temperature of 200° F. is flowed into the space between panel and tube through a flat-tipped nozzle.

Inspection and salvage: Directly underneath the filling station a lighted mirror permits observation of resin flow across the panel. If any difficulty is noticed immediately, the panels and tubes are easily separated. After 5 min. of cure, the resin has hardened sufficiently to make separation of tube and panel difficult. This inspection equipment is important because any scrap in this process, if not handled promptly and properly, results in time-consuming salvage work or complete loss of otherwise good tubes.

Packaging: Once the resin and hardener have cross-linked sufficiently to prevent flow (about 20 to 25 min.), the laminated assemblies may be packaged.

Details of these steps may vary from tube plant to tube plant, but in their basic outline they will hold true for all. In general, the laminating operation is a completely separate and additional process performed on otherwise finished and tested tubes.

Shell Chemical Co. recently developed a resin for this application (Epon 892), which they introduced commercially in mid-June. In addition to TV tubes, the company expects it to go into other safety glass applications as well. The process of laminating with the Shell resin is very much the same as for the Dow system, except that the Shell system cures at room temperature in 5 to 10 minutes. As this issue was going to press, most of the tube makers were beginning evaluation programs of the Shell system.

It looks as though epoxies have entered a new and very promising market.—**End**

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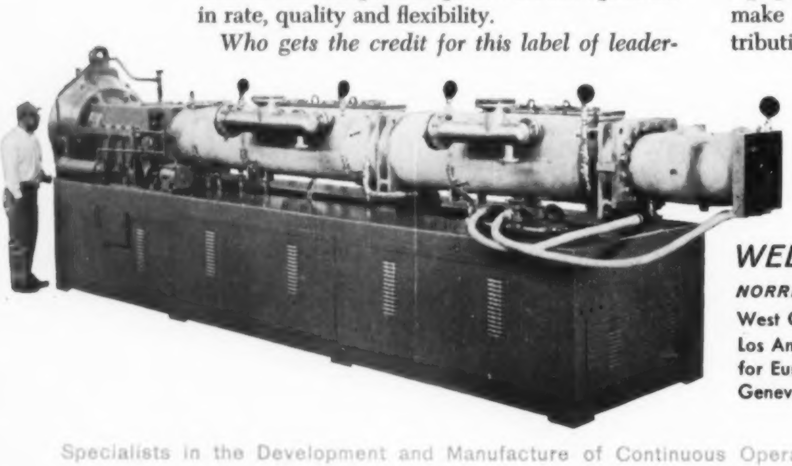

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Injection molding FEP-fluorocarbon resin

By H. A. Larsen†, G. R. DeHoff†, and N. W. Todd†

The operating conditions under which Teflon[2] FEP-fluorocarbon resin can be satisfactorily injection molded are directly related to the rheological properties of the molten polymer. Especially important: the shear rate of the melt as it flows into the mold should not exceed the "critical" shear rate at which flow instability occurs in laboratory flow measurements. Delamination, which is likely to occur if the critical shear rate is exceeded, can be avoided by lowering ram speed, by enlarging gates, and by increasing melt and mold temperatures. The ultimate elongation of parts injection molded from FEP resin depends somewhat upon molding conditions. Tensile strength and flexural modulus, however, are essentially constant over a limited range of molding conditions. Delamination reduces elongation. Pieces held at high temperatures for a month, in air and in a few likely chemicals, changed dimensions by only 0.2% or less, showed up to 9% loss of strength and in some instances suffered a moderate decrease in ductility.

FEP-fluorocarbon resin is a completely fluorinated copolymer made from tetrafluoroethylene and hexafluoropropylene. Like the TFE homopolymer, FEP resin is chemically inert, has useful strength and stiffness over temperatures from —300 to over 400° F. It has excellent weatherability, a low coefficient of friction, low permeability to most reagents, and outstanding electrical properties. These and other properties have been discussed in detail by Mallouk and Thompson (1)[1], and by Mallouk, Siegle, and Straw (2).

Unlike TFE resin, FEP resin can be melt fabricated in conventional plastics processing equipment, and its extrusion was discussed by Mallouk (1). The present discussion deals with the injection molding of FEP-fluorocarbon resin. We will show how the rheological properties of this resin determine the required molding conditions.

Rheological properties

The rheological data most pertinent to injection molding are those relating viscosity to shear stress and shear rate. These data may be obtained by measuring the pressure drop across tubes of known dimensions through which molten polymer is flowing at a measured constant rate. A series of measurements are made at each of several flow rates. For generality, the results are then expressed in terms of shear rates, shear stresses, and apparent viscosities. Data obtained for Teflon FEP resin at 735° F., for **(To page 92)**

*Reg. U. S. Pat. Off.

Adapted from a paper presented at the 15th Annual Technical Conference of the Society of Plastics Engineers, New York, Jan. 1959.

†Polychemicals Dept., E. I. du Pont de Nemours and Co., Wilmington 98, Delaware.

[1]Numbers in parentheses link with references at end of article, p. 96.

[2]Registered trademark of Du Pont.

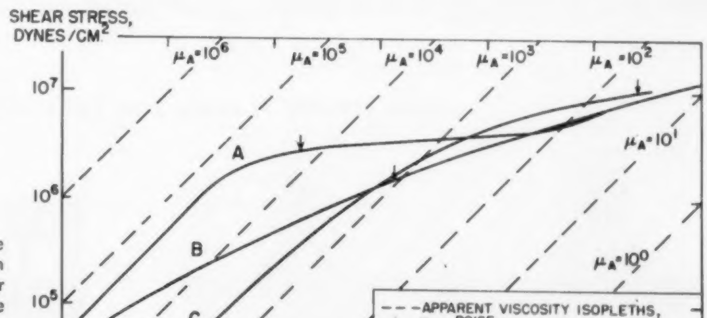
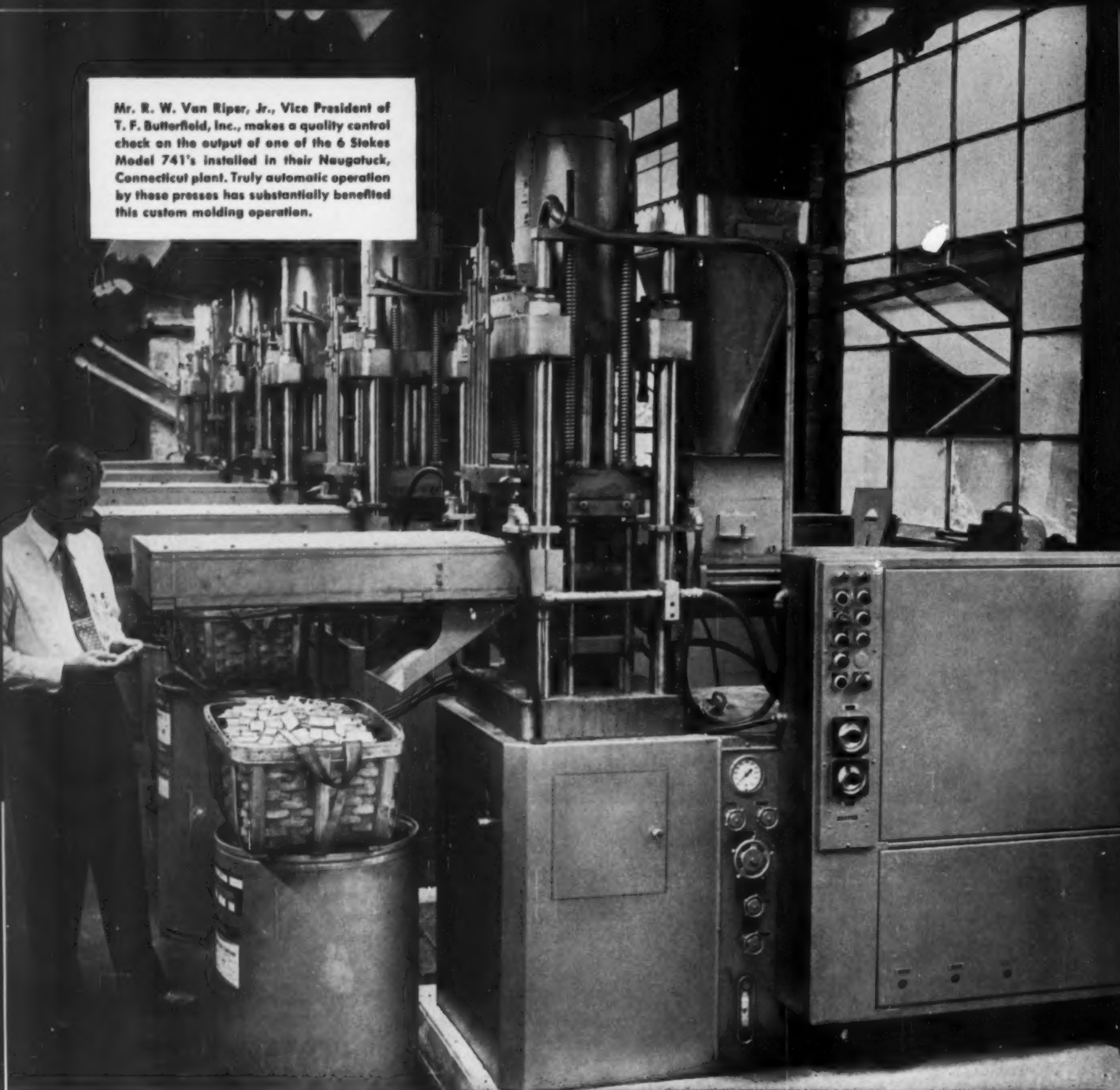
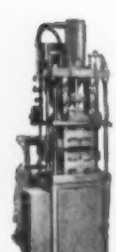


FIG. 1: Flow characteristics of three thermoplastics at typical injection molding temperatures. Curve **A:** for Teflon FEP resin at 735° F.; Curve **B:** for Alathon 10 PE at 430° F.; Curve **C:** for Zytel 101 nylon at 535° F. Note that critical shear rate for FEP resin is only 200 sec.$^{-1}$, and that its apparent viscosity decreases rapidly as shear rate is increased beyond this value.

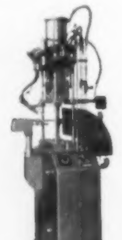


Mr. R. W. Van Riper, Jr., Vice President of T. F. Butterfield, Inc., makes a quality control check on the output of one of the 6 Stokes Model 741's installed in their Naugatuck, Connecticut plant. Truly automatic operation by these presses has substantially benefited this custom molding operation.

OTHER STOKES PRESSES FOR THERMOSET MOLDING

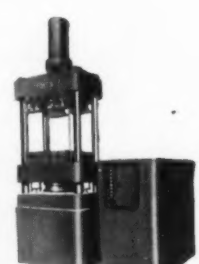


The Stokes Model 900 automatic . . . 15 and 25 ton models. Has all the advanced features of the larger Model 741's.



The Stokes Model 725 automatic . . . 25-ton capacity. A simple low cost machine for varying production runs.

The Stokes Model 726 semi-automatic compression molding press. 50, 100, 200 and 300 ton models.



The Stokes Model 727 semi-automatic transfer molding press. 50, 100, 200 and 300 ton models.

	RAM SPEED IN./MIN.	SHEAR RATE SEC.$^{-1}$
A	3.5	55
B	4.3	70
C	7.0	110
D	9.7	150

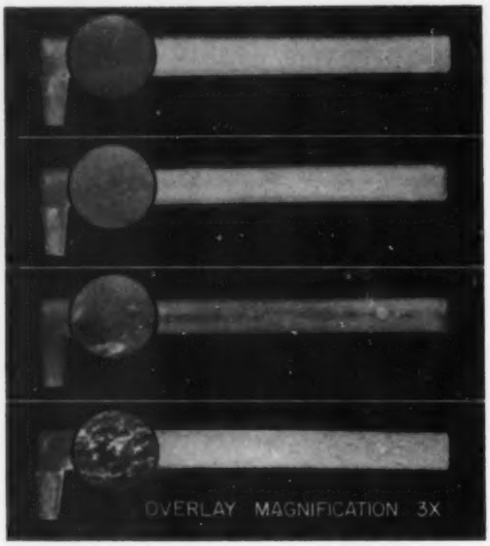


FIG. 2: Surface appearance of FEP moldings deteriorates as shear rate during injection passes through critical range. Bars were molded in a 2-oz. Watson-Stillman machine at a stock temperature of 735° F., a mold temperature of 360° F., a ram pressure of 10,400 p.s.i., and on a 75-sec. cycle of which 45 sec. was used in injection, 30 sec. in cooling. Bars are 0.5 actual size, overlays are magnified 3 times.

Alathon[3] 10 polyethylene (melt index = 2, density = 0.923) at 430° F. and for Zytel[4] 101 type 66 nylon at 535° F. are presented in Fig. 1, p. 89. The temperatures at which these data were determined are typical melt-processing temperatures for these resins.

A convenient way to relate the data of Fig. 1 to the injection molding operation is to realize that for a given mold and molding machine, shear rate is determined by actual ram speed during injection.

The molding counterpart of shear stress, as shown in Fig. 1, which is the pressure drop encountered as polymer flows through the nozzle, runners, and gates into the mold cavity.

The dotted lines of Fig. 1 are lines of constant apparent viscosity, which is defined as the ratio of shear stress to shear rate. It can be seen that, for each of these three resins, the apparent viscosity decreases with increasing shear rate in a manner which is a characteristic of each polymer. At a given temperature, there is a critical value of the shear rate for each resin which is indicated in Fig. 1 by a small arrow. Forcing a thermoplastic resin through an orifice at a shear rate greater than this critical value results in roughness in the extrudate. Tordella (3 to 6) and others (7 to 10) have investigated this roughness extensively.

There are two features of Fig. 1 which are of particular importance. First, the critical shear rate of FEP resin at 735° F. (200 sec.$^{-1}$) is significantly lower than the critical shear rate for the polyethylene resin at 430° F. (1300 sec.$^{-1}$) or for the nylon resin at 535° F. (250,000 sec.$^{-1}$). Second, there is an abrupt decrease in the apparent viscosity of FEP resin in the vicinity of the critical shear rate, so that at shear rates in the vicinity of 10,000 sec.$^{-1}$ the apparent viscosities of all three plastics at their molding temperatures are nearly the same.

Typical molding conditions

Differences in the rheological properties of these three resins are reflected in the operating conditions under which satisfactory moldings can be made. This point is illustrated in Table I, below, which shows typical operating conditions which have been shown to be satisfactory for producing 5-in. ASTM tensile bars of FEP resin, of PE, and of nylon. The melting points of these three resins are also shown.

The most significant differences in molding conditions between FEP resin and the other two resins are as follows: 1) for FEP resin considerably higher stock and mold temperatures are required; 2) with FEP resin it is desirable to operate with low ram speeds; 3) the required ram pressure is lower for FEP resin than for the comparative resins.

It will be seen that differences in molding conditions for these three resins reflect the differences in their respective flow properties (Fig. 1).

Relationships between molding conditions and flow properties

In order to understand the relationship between molding conditions and rheological properties, it is necessary first to understand the phenomenon of delamination. Delamination is the separation of the surface layers of injection molded pieces from the bulk of the part. In severe instances the surface of the part has an appearance similar

Table I: Satisfactory molding conditions for 5-in. ASTM tensile bars

	Teflon 100X FEP-fluorocarbon resin	*Alathon 10 polyethylene resin*	*Zytel 101 nylon resin*
T stock, °F.	735	430	550
T mold, °F.	425	95	150
Ram pressure on material, p.s.i.	10,000	15,000	20,000
Ram speed, in./min.	10	100	100
Cycle, sec.:			
Injection	50	20	20
Cooling	10	10	10
Melting point, °F.	545	230	495

[3, 4] Registered trademarks of Du Pont.

to fish scales. In less severe instances the part may appear sound, but repeated bending through a large angle results in a separation of the surface layers. Delamination is a problem to the injection molder with a number of thermoplastic resins, but in each instance the problem can be avoided through proper selection of operating conditions.

Delamination is related, at least in some instances, to the sort of flow instabilities mentioned in References 3 to 10. Illustration of this relationship is presented in Fig. 2, p. 92, which shows a series of ASTM flex-modulus bars injection molded from FEP resin at various ram speeds.

As seen in this photograph, Bars *A* and *B* are of high quality and show no surface delamination. Bar *C* has a slight surface roughness which does not show up well in the photograph, whereas Bar *D*, which was molded with the highest ram speed, has a poor surface which is characteristic of delamination. It is of interest to relate the ram speeds used in making these bars to the flow data of Fig. 1. Calculations of maximum shear rate is the easiest way in which such a relationship can be made. As a first approximation, shear rate is expressed by Eq. 1, which gives the shear rate at the wall for a Newtonian fluid flowing steadily at a constant temperature in a rectangular channel having a large ratio of width to thickness.

$$\dot{\gamma} = \frac{6Q}{Wt^2} \qquad \text{Eq. 1}$$

$\dot{\gamma}$ = shear rate, sec.$^{-1}$.

Q = volumetric flow rate as determined by ram diameter and ram speed, in.^{3}/sec.

W = width of rectangular channel in.

t = thickness of rectangular channel, in.

The appearance of surface delamination was noted in Bars *C* and *D* in Fig. 2 where the shear rates were 110 and 150 sec.$^{-1}$, respectively. These numbers are reasonably close to the value of 200 sec.$^{-1}$ given in Fig. 1 as the critical shear rate at which FEP-fluorocarbon resin shows flow instability at 735° F. These results show that ram speed can be a critical operating

	GATE SIZE IN.	RAM SPEED IN./MIN.	SHEAR RATE SEC.$^{-1}$
A	0.050x0.050	80	11,200
B	0.250x0.090	80	700
C	0.250x0.189	16	33

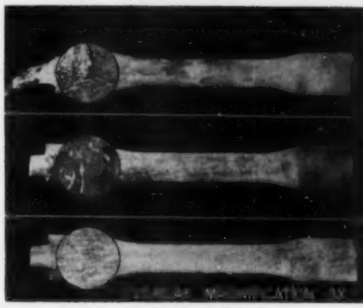


FIG. 3: Effect of gate dimensions on quality of molded parts. Machine was 2-oz. Moslo; stock temperature was 740° F.; mold temperatures were: **A**—475° F., **B**—430° F., **C**—400° F.; ram pressure was 12,000 p.s.i.; and cycle was 30 sec. for injection, 30 sec. for cooling. Pieces 0.4 actual size, overlays 3X. FEP resin.

factor in the injection molding of FEP resin.

Operation with a slow ram means that the greatest portion of the cycle must be devoted to injection time. Such a situation does not necessarily mean long over-all cycles, however, because the cooling which takes place during the slow injection of the polymer permits a reduction in the required cooling time. Of course, it is necessary to have the ram advancing slowly only when it is actually injecting polymer. It is an easy matter to provide for rapid ram movement just prior to the point where the advancing ram first meets the polymer and then to provide for slow ram movement while melt is flowing into the cavity.

It is important to realize that a low ram speed is used merely to achieve high quality in the pieces, not to overcome any difficulty in filling a cavity with FEP resin. It was pointed out in Table I that unusually low ram pressures can be used to injection mold this material. This situation with FEP resin is due partly to the low pressure drop across typical heating cylinders—on 1500 to 5000 p.s.i.—and decrease in apparent viscosity as shear rate is increased beyond critical value. See Fig. 1.

Although the use of pinpoint gates is not recommended with FEP resin, experience with this technique provides an example of the ease with which this polymer tends to flow at high shear rates. A coil form weighing 6.5 g. was easily filled through a pinpoint gate 0.015 in. in diameter and 1/8 in. long. Ram pressure was only 8500 p.s.i. The finished parts were of good quality except in the immediate vicinity of the gate where the effects of melt fracture in the gate were evident in the final part as delamination.

Referring again to Eq. 1, it can be seen that, in addition to volumetric flow rate (ram speed), the channel dimensions are also important determinants of shear rate;

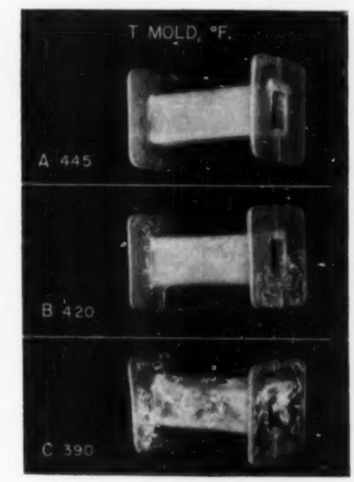


FIG. 4: Delamination due to high shear rate is healed when mold is hot enough. Well molded coil form withstands 1 hr. at 515° F., while those made in colder molds deteriorate. These were molded in 2-oz. Watson-Stillman at a stock temperature of 720° F., ram pressure of 4000 to 5000 p.s.i., and a cycle ranging from 20 to 30 sec. for injection, 10 to 15 sec. for cooling. FEP resin.

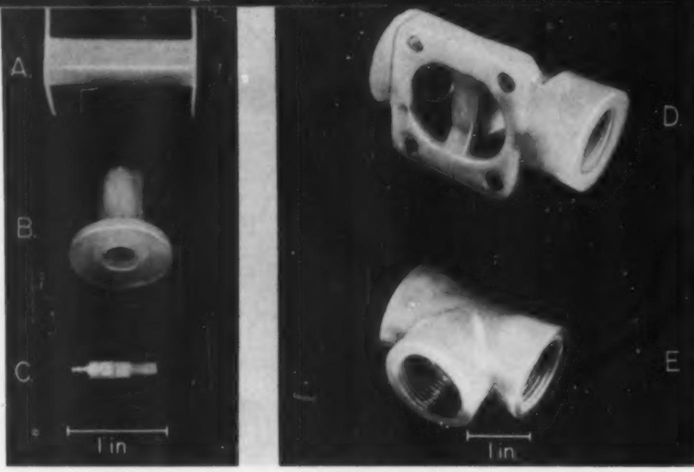


FIG. 5: Typical parts injection molded of FEP. A: coil form; B: connector; C: electric terminal with insert (Excellex Industries); D: part of Grinnell-Saunders-type diaphragm valve (Tube Turns); E: pipe tee.

according to Eq. 1, the section in any given molding where the value of width × (thickness)^2 is smallest will have the highest shear rate and will thus be the critical section as far as delamination is concerned. This thinking is verified by the evidence of Fig. 3, p. 93. Bars *A* and *B* of Fig. 3 were molded with a high ram speed in cavities having gates of different size. Bar *A*, which had a smaller gate, was molded at the higher shear rate. Although both pieces show considerable delamination, it is clear that the delamination in Bar *A* is more severe than the delamination in Bar *B*. Bar C was molded at the same stock temperature and at a lower mold temperature than Bars *A* and *B*, but the shear rate was reduced both by enlarging the gate still further and by reducing ram speed. As shown in Fig. 3, Bar C is of high quality and exhibits no delamination. The observed difference in surface quality is due to the variation of shear rate, rather than mold temperature since, as will be shown, surface appearance of moldings of FEP resin improves as mold temperature is raised.

To produce high-quality moldings of FEP resin, the polymer flowing into the cavity must be kept hot. Since a given injection rate temperature of this melt depends on both the stock temperature and the mold temperature, both these temperatures must be kept high. The need for high melt temperatures is related to the rheological properties of the polymer. Unlike 66 nylon, which becomes quite fluid at temperatures slightly above its melting point, FEP resin melts to a viscous material having a low critical shear rate. Raising the temperature to a level well above the melting point both reduces viscosity and raises the critical shear rate, thus making FEP resin easier to mold. Fortunately, the excellent thermal stability of FEP resin, which is due to its completely fluorinated structure, makes it possible to heat this polymer as high as 750° F. (205° F. above its melting point), with no appreciable degradation during the hold up times encountered in typical molding cycles and cylinders.

With some mold cavities, it is impractical to operate in such a way that the shear rate of the flowing polymer is below the critical value in all parts of the mold. For example, shear rates well above the critical value might be encountered during the flow of FEP resin through the gates of a multiple-cavity mold. In this instance, the melt flowing through the gates would have rough surfaces due to flow instabilities associated with the high shear rates. After the polymer flows through such gates, the shear rate is reduced, and, if stock temperature and mold temperature are high enough, this roughness can heal (weld). An example of this are some coil forms which were molded in such a way that the shear rate in the gate was about 8000 sec.$^{-1}$ As this shear rate is roughly 60 times the critical shear rate of the polymer at the stock temperature used, the melt entering cavity must have been roughened by flow instabilities. If flowing melt is hot enough, the part looks good and is free from delamination because the high temperatures involved have permitted the fractured resin to heal as the cavity filled. With coil forms molded at lower mold temperatures the melt was so chilled by the time the cavity was full that the delamination could not heal. This delamination, difficult to detect at the time of molding, became quite apparent after these same coil forms were heated for 1 hr. in an air oven at 515° F. The heated forms are shown in Fig. 4, p. 93. Note that Form *A*, molded at a mold temperature of 445° F., still shows no sign of delamination.

When molding FEP resin, it is sometimes difficult to eliminate the effects of delamination in the gate region. In such instances, it is often helpful to separate the gate from the cavity by a tab section. The delamination near the gate is then confined to this tab, which is trimmed off the molded piece.

Fig. 5, above, is a photograph showing a variety of good parts injection molded from FEP resin by the techniques discussed above. The parts vary in size and com-

Table II: Molding conditions and mechanical properties of tensile bars fabricated from FEP resin

Test	*Stock temp.*	*Mold temp.*	*Ram speed*	*Tensile strength*	*Ultimate elongation*	*Flexural modulus*
	°F.	°F.		p.s.i.	%	p.s.i.
2	715	410	slow	2140	198	84,500
3	760	410	slow	2110	155	83,300
4	760	410	fast	2120	157	87,200
7	715	435	slow	2250	179	79,800
9	760	435	slow	2290	266	83,500
10	760	435	fast	2370	336	81,500

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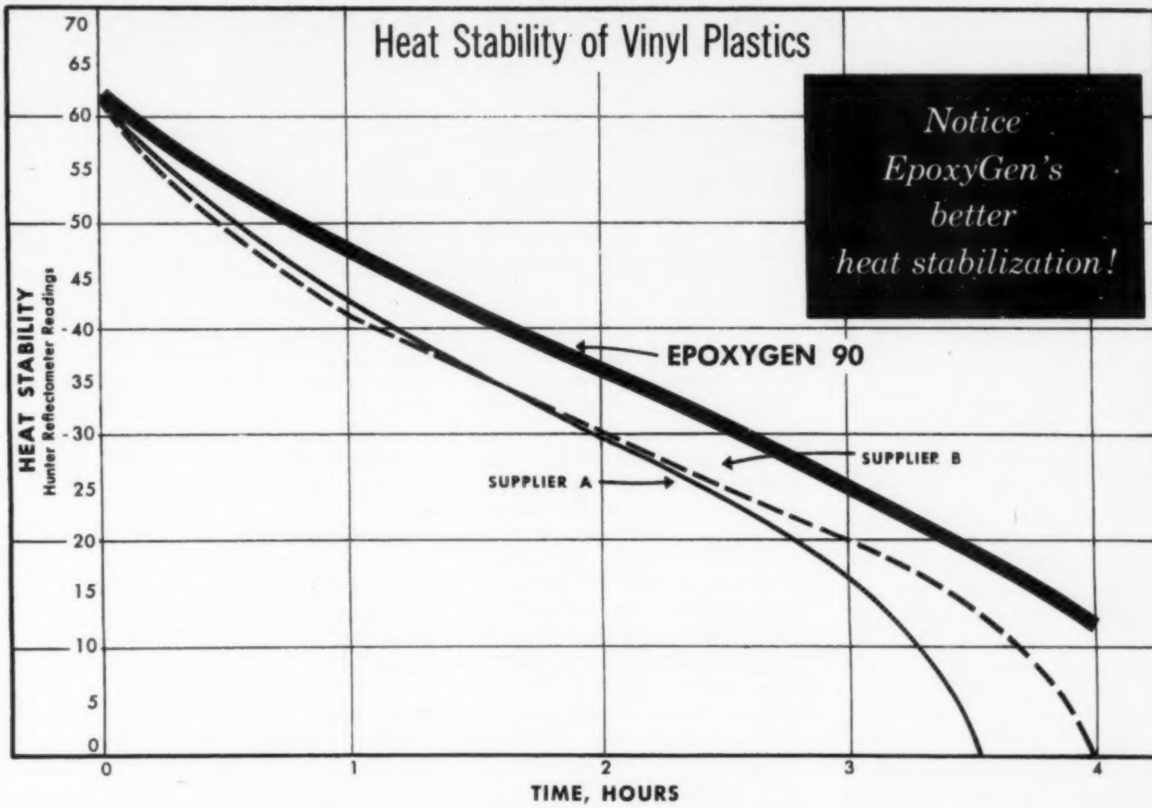

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Properties of injection molded parts of FEP-fluorocarbon resin

The mechanical properties of parts molded from FEP resin depend upon molding conditions. To illustrate this effect, ASTM tensile bars molded at the conditions listed in Table II, p. 94, were tested for tensile strength, ultimate elongation, and flexural modulus. The results, which also appear in Table II, indicate that tensile strength and flexural modulus are essentially constant over the range of molding conditions investigated, whereas ultimate elongation varies somewhat with molding conditions. Visual examinations of these molded bars showed, as expected from the discussion above, that: 1) the best pieces were made at the highest stock and mold temperatures; 2) at intermediate temperatures good parts were made only when using a low ram speed; and 3) at the lower temperatures, the effects of delamination could not be completely eliminated. In general, the parts which had the highest quality as determined by visual observation had the greatest ultimate elongation.

Tensile bars molded under the conditions listed in Table II were also tested after a one-month exposure in several environments which were chosen for their importance in end-use applications. The results of these tests for one set of molding conditions are presented in Table III, above. They show that these exposure conditions do not have any significant effect upon tensile strength, but under some conditions there is a decrease in ultimate elongation. None of these exposure conditions significantly affected the dimensions of the molded pieces. Further work along these lines is currently underway to define further the limiting exposure conditions for a wide variety of other environments under which FEP resin may be successfully used.

Table III: Mechanical properties of injection molded FEP resin tensile bars after one month in various environments (All bars from Experiment 9 of Table II)

Environment	*Temperature*	*Tensile strength*	*Ultimate elongation*	*Change of length*
	°F.	p.s.i.	%	%
Control	—	2290	266	—
Skydrol[a] hydraulic fluid	270	2220	260	+0.1
Cyclohexane	75	2190	240	0.0
Silicone oil	390	2090	150	0.0
Air	435	2180	110	—0.2

[a]Registered trademark of the Monsanto Chemical Co.

Other considerations

Equipment for molding FEP resin should be capable of operating at the necessary temperatures and should be constructed of materials that will resist corrosion. While experimental work can be done without completely corrosion-resistant construction, prolonged operations require such provisions for best results. Generally speaking, machines currently in use with PVC resins or with polychlorotrifluoroethylene resins should be suitable for FEP resins with respect to corrosion resistance. The critical parts are, of course, those contacted by the hot resin—the cylinder liner, the spreader, the nozzle, and the mold runners and cavities. Although experience is still being gained with various materials of construction, high-nickel alloys such as Hastelloy[5] C, Duranickel[6], Xaloy[7] 306, and K Monel[6], have proved to be quite resistant to attack by molten FEP resin.

The cooling of perfluorocarbon polymers from the melt to room temperature is accompanied by a relatively large rise in density, i.e., large shrinkage. Depending on the wall thickness of the article, the molding conditions, and the mold design, shrinkages of 0.030 to 0.060 in./in. will be experienced. As was pointed out in Table III, however, well molded parts do not subsequently change dimensions even under severe exposure conditions.

Reworked material such as reground sprues, runners, and trimmings from molded FEP resin can be reused provided it has not been degraded or contaminated.

When heated above 400° F., small quantities of gaseous decomposition products are evolved from FEP-fluorocarbon resin. Some of these gases are harmful and must be eliminated by adequate ventilation. A good exhaust should be provided where the mold opens, near the nozzle, and over the area where samples are cooling.

[5]Registered trademark of the Haynes Stellite Co.
[6]Registered trademark of the International Nickel Co.
[7]Registered trademark of the Industrial Research Laboratories.

Acknowledgment

The authors wish to express their gratitude to T. R. Wallingford for assistance in evaluating the properties of injection molded pieces.

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How to make roll-chilled polyolefin films commercially

A leading producer of roll-chilled (commonly called 'cast') film tells how it is done and gives the conclusions he's reached in over a year's experience with the process

By Fred J. Meyer†

The improved clarity and surface gloss, stiffness and strength of the new cast polyethylene films produced by flat-film extrusion onto chilled rolls is having a marked impact on current packaging applications of polyethylene bags, and is accelerating the use of polyethylene in packaging and overwrap. New markets opened up by the startling characteristics afforded by the new casting technique may double polyethylene film consumption in flexible packaging in three to four years.

Pioneering efforts by Texas Plastics, Inc. in the field of casting, partly carried out in cooperation with U. S. Industrial Chemicals Co., were initiated after an analysis of the deficiencies of polyethylene films currently available. Our investigation had indicated that water-quenched film will not attain the required stiffness and slip properties, and that blown film shows gage variations up to ±20% or more. (See Table 1, right, and footnote thereto.) These shortcomings make the "conventional" types of polyethylene film basically unsuitable for the bulk of the automatic packaging and overwrap applications and non-competitive with cellophane in other large-volume markets. Cast film, on the other hand, has outstanding optical properties equaling those of cellophane, good stiffness and slip, and can be produced with narrow gage variations.

Flat- vs. blown-film extrusion

The main factor limiting the production rate in flat-film extrusion into water is the water carry-over which increases with increasing amounts of slip additives and most anti-block agents. Water carry-over also prevents effective film treatment by either electrical or flame methods to make the film surface receptive for printing with inks.

Higher production rates can be attained by means of wider dies (which generally create problems), sets of squeeze rolls in the film wind-up, air knives or doctor blades, by subsequently coating a solution of slip additive on the film surface, or by use of resins containing little or no slip additives or anti-block agents. However, rolls of film made from resins containing no appreciable amounts of these additives block so badly that they cannot be unwound, and the film itself "drags" so severely that it is not suitable for overwrapping or automatic packaging.

More uniform gage is generally possible with flat film extruded from a slot die than with tubular film because of advantages of flat-die design and better control of cooling. Tolerances of ±0.1 mil are readily maintained in widths up to 40 in. and in thicknesses from 1 to 2 mils. The primary advantage of water-quenched flat-film extrusion for automatic packaging and overwrapping lies in such constancy of gage.

High-clarity, high-strength films can be made by means of high compound temperatures and

Table I: Thickness variations[a] in commercially blown polyethylene films (tubular or "lay-flat")

Nominal gage	*Minimum thickness in test sample*	*Maximum percent*	*Maximum thickness in sample*	*Maximum percent*
mils	*mils*	*low*	*mils*	*high*
0.75	0.50	33	0.90	20
1.00	0.70	30	1.20	20
1.25	0.91	27	1.50	20
1.5	1.13	25	1.73	15
2.0	1.75	13	2.26	13
2.5	2.20	12	2.80	12

[a] These values are representative of the extreme values found in many crosswise profiles of about 25 measurements. Assuming that film thickness is "normally" distributed, the total spread, between the smallest and largest of 25 measurements, will on the average, equal almost four times the standard deviation. In the case of the 1-mil film, for example, the total spread, or "range," is about 50 mils. This would correspond to a standard deviation of about 13 mils. On the basis of 25 measurements, the corresponding 1% "confidence limits" for gage would be about 0.95 ±0.36 mils. In practical terms, this means that about 1% of all the film in such rolls will be less than 0.6 or more than 1.3 mils thick! The above computation and future discussion of variation in this article are based on the assumption that thickness variations measured in the machine direction are small in comparison with the transverse ones. Were this not the case, the two kinds of variation would have to be combined to obtain true over-all confidence limits (even wider than these!) for the gage.—*Ed.*

†General Manager, Texas Plastics, Inc., Elsa, Texas.

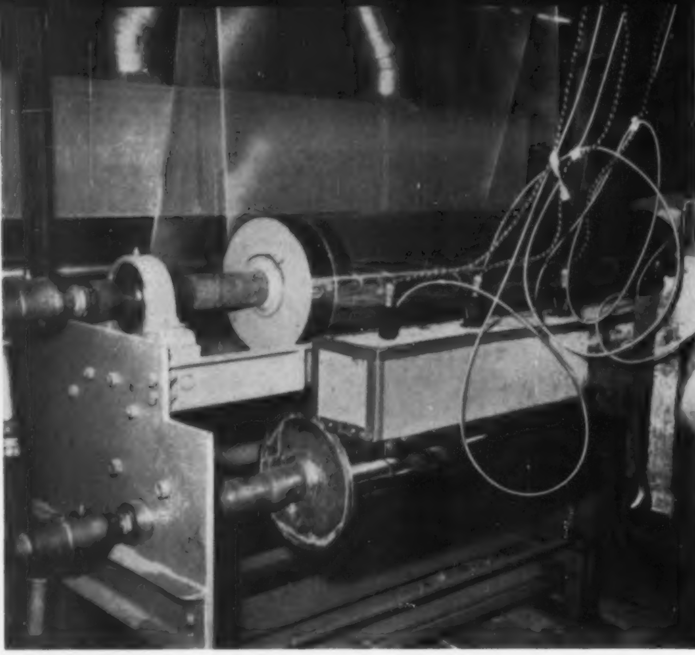

FIG. 1: One end of a T-slot die, showing polyethylene film being extruded vertically downward onto a chill roll, then following S-shaped path around and up onto the second chill roll.

low water-bath temperatures (110 to 120° F.). Film produced under these conditions, however, has had severe wrinkles that make wind-up virtually impossible. Operation at lower compound temperatures and high water bath temperatures (around 165° F.) eliminates wrinkling but results in a film with impaired clarity and strength. Using intermediate compound and water bath temperatures produces a highly satisfactory commercial film.

The fundamental design of the tubular extrusion die with its concentric outer ring and mandrel limits the gage control of blown film. According to spot tests we have made on commercially blown film, approximate commercial variations are as shown in Table I. To obtain film rolls of smooth, uniform appearance in spite of such gage variation, a variety of devices is used singly or in combination, such as rotating or reciprocating dies or cooling rings, turbine-type cooling rings, slowly rotating wind-ups. The spiraling effect of such devices distributes the gage variations evenly throughout the length of the roll, so that roll thickness is equal at all points.

Conventional equipment used for extruding polyethylene flat film into a water bath or for substrate coating is fundamentally suited for extrusion onto chilled rolls. The same extruder can be used, with the flat-slot, split-"T" die. The film contacts the first of a series of two or three chill rolls tangentially. The design of the chill rolls, which are cored for water cooling, is extremely critical. The temperature differential across the roll face should be no more than 3 or 4° F., lest nonuniform cooling affect the film properties. Extremely highly polished, mirror surfaces must be achieved on the chrome-plated rolls, since the film surface is a faithful reproduction of the roll surface.

The film emerges vertically downward from the die and "S"-wraps around the chill rolls. (See Fig. 1, above). A series of idler rolls is used to afford sufficient time in the air for further cooling the film before it is wound.

The pull rolls on the wind-up are of the "S"-wrap variety rather than the "nip" type, which would tend to press any existing wrinkles into the cast film. These pull rolls are of aluminum and should be cored for cooling, as, according to our experience, the high extrusion speeds achieved which may be obtained in casting would otherwise make it impossible to cool the film adequately without an exceptionally long film wind-up unit. Standard-type, dancer-roll controls with turret wind-ups are satisfactory. Spreader rolls of any type are *not* recommended: they may mar the film surface or introduce cold stresses to the film (which would later distort the printed design when the stresses are relieved as the film passes through the oven of the printing press). The wind-up unit is shown in operation in Fig. 2, p. 100.

To obtain the necessary degree of working and homogenization in short-barreled extruders with L/D ratios of 13:1 or less, we used a screen pack of the following mesh sizes: 30/70/100/200/200/70. In extruders with long barrels (with L/D ratios in the range of 20-24:1) the 200-mesh screens can be reduced to 120 or 150 mesh and the pack modified to 30/70/100/150/70 without impairing the final characteristics of the film. Production rates were not appreciably reduced by the use of fine screen packs. Packs were changed after approximately 120 hr. of continuous operation.

Results of cast-film making

We are using the chill-roll technique to make film for more than 2,000,000 bags daily. For the most part, we use high-pressure polyethylenes with densities ranging from 0.917 to 0.940 chiefly U. S. I. 205 (M. I., 3.0; density, 0.924) and 239 (M. I., 5.0, density, 0.929). Some runs have also been made on linear polyethylenes having densities of 0.94 to 0.96, and on polypropylenes.

For all runs, a standard M. P. M. extruder with metering-type screw was used. The screw has a constant pitch, decreasing channel depth, a 3-flight metering section, compression ratio of 4:1.

Following are the principal results and observations derived from our experience with low-density polyethylene.

1) Production rates for cast film were about 31% higher than those for flat-film extrusion into a water bath. An extended test run was made over a 120-hr. period with identical 3.5-in. extruders (13:1 L/D barrel ratio,

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with 15-hp. U. S. Varidrives), using 39.5-in., split-type, slot-opening, "T" dies, with 20-mil gaps, extruding 35.2-in.-wide, 1.25-mil-gage films from 0.923-density resin with these results:

	Water bath	*Casting*
Total for 120 hr./lb	15,645	20,408
Avg. production, lb./hr.	abt. 130	170

The difference in the production rates may be mainly attributed to the elimination of water carry-over in casting. Films produced by both methods had comparable gage control (range 1.20 to 1.35 mils), but the cast film was definitely superior in gloss, clarity, and strength. The resin used in both extruders was identical and was "tailored" for optimum water bath extrusion.

2) The final characteristics of cast film are predicated predominantly on the resin being used. In attempting to hit on the best all-round resins for the process, a great many were tried. Some gave a beautiful glass-like film, while others caused a pasty build-up on the chill rolls, resulting in a blotchy effect on the film. This problem is apparently related to the specific slip additives and anti-block agents used by the various resin manufacturers; we found that it could readily be solved by switching from one resin to the other.

3) Cast films have always shown much higher degrees of gloss and clarity than could be obtained with the same resins by the flat-film, water-bath, or the tubular methods. We also found that, under the same provision, stiffness and strength were improved. The range of film gages covered in these tests was 0.5 to 9.0 mils.

4) Tearing tests indicate that cast film is much more isotropic than water-quenched film, that is, its tear strengths in the machine and transverse directions are almost equal. In this respect it resembles blown film more closely than water-quenched flat film. This is probably due to the fact that the drawing of cast film is accomplished entirely in the air gap while the film is very hot, whereas water-quenched film continues to be drawn while it is cooling with no chance for subsequent relaxation of drawing-induced stresses.

5) The distances between the die and the contact point on the casting roll was varied from 1.5 to approximately 5 inches. As the distance increased, the degree of machine-direction orientation in the film increased, as did the "neck-in" of the extruded film. Gage control was easier at air-gaps under 3 inches.

6) In spite of the very smooth surface finish of these films, blocking was not a problem in either the wound-up rolls or the bags made from the film. On the contrary, it was easy to make films having excellent slip. In a test run made at the David Freedman Co., El Centro, Calif., two million bags were packed, half of them made from roll-chilled film, half from water-quenched film. The cast film bags were packed 20% faster because they opened more easily, because of better slip and higher stiffness. Not one roll-chilled-film bag was broken, whereas breakage on the water-quenched-film bags amounted to about 0.2%, or roughly two thousand bags.

7) The slip or anti-block properties of the films produced did not vary as long as resin of one specific type was employed.

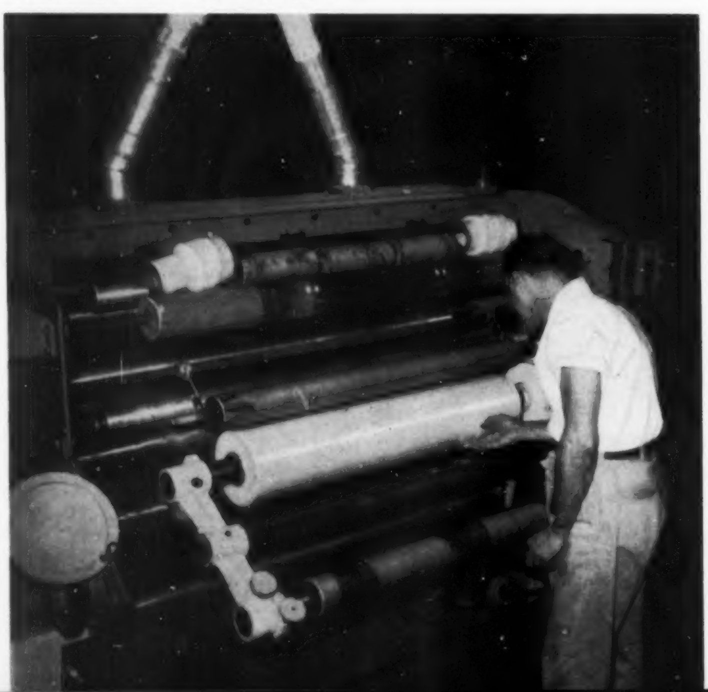
8) We found that the cast films of a given thickness seemed stiffer than their water-quenched counterparts, probably because of greater crystallinity.

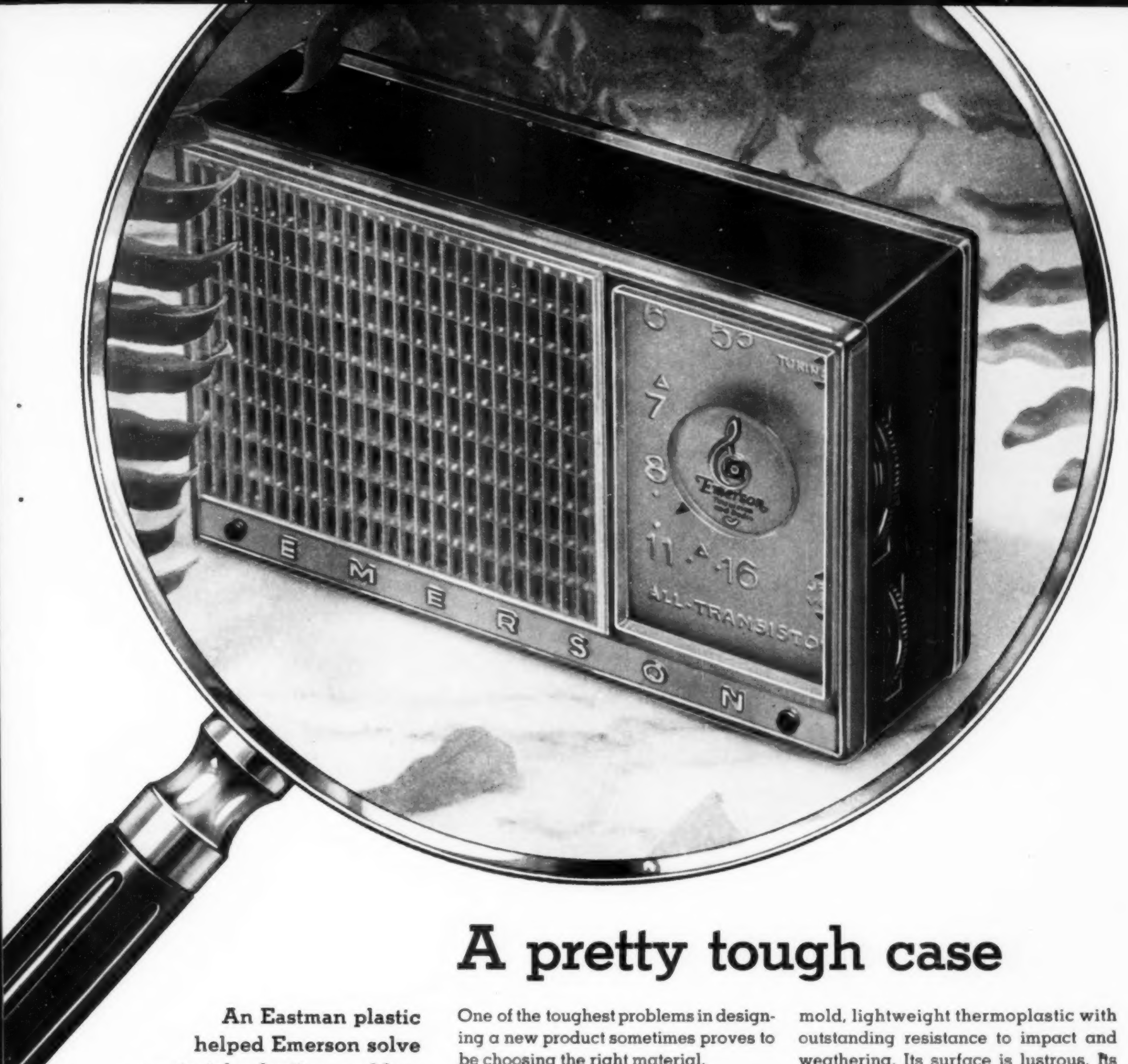
9) Cast film could be readily treated for printing by conventional flame or electrical methods without any modification of existing equipment. The treatment remained effective over periods up to six months (current limitation of tests), regardless of the degree of slip and anti-block additives, clarity or gloss. No changes in printing operations were required.

10) The clear, sparkling cast films were easy to print on beautifully. The increased strength and stiffness, and the high slip of our cast films permitted printing of carrot bags in three colors, using 0.9-mil film. The 35-in.-wide film printed at 450 ft./min. with 0.2% press scrap, and bags were then made at regular speeds with normal scrap, using conventional bag-making machinery. More than 250,000 of these bags were evaluated by the F. H. Vahlsing, Inc. carrot-packing shed at Hereford, Texas, with breakage and other losses totaling 0.5 percent. (Bags made of 1.25-mil *water*-quenched film had losses of 0.2 percent).

11) Satisfactory seals with adequate time-pressure-temperature ranges were obtained with cast film at the same **(To page 182)**

FIG. 2: Operator inspects the roll-chilled film as it is wound into a smooth roll of even thickness.

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Continuous blow-forming of extruded tubing

A preliminary report on a novel way of forming certain classes of hollow objects

By T. Kasahara†

Since February, 1956, we have been experimenting with a novel method for forming hollow shapes from freshly extruded, thin-wall tubing. Using this process, which might be termed "bulge extrusion" or "extrusion/blow-forming," we were able to manufacture, at greatly reduced cost suppository containers that formerly were blow molded. The ultimate commercial importance of the process is difficult to assess at this time, since so many technical questions remain to be answered. At present, however, it seems that it will be impossible to make abrupt changes in cross section, such as the change from the neck to the body of a blow-molded bottle, because impossibly high rates of cooling would be required. For related reasons, there will be a practical upper limit on wall thickness. Within these limitations, the process should be attractive for forming many useful shapes, such as those sketched in Fig. 1, right.

How it works

Bulge extrusion consists of extruding a polyethylene tube upward toward a pair of pinch rolls. Between the pinch rolls and the extruder die is a pair of movable guide plates whose motion is controlled by a mechanical linkage operating off a cam that is geared to the pinch-roll drive. As the tube emerges from the extruder, it is inflated as in making the familiar blown film. However, the degree of blowing, instead of being uniform, is controlled by the position of the guide plates in such a way that the diameter of the tube can increase over a short length to a value up to at least 10 times that of the uninflated tube. Since the plate motion is synchronized with the take-off rolls, the over-all result is a cyclic variation in the diameter of the finished tube. The nature of this variation, i.e., the inflated shape, is to some degree controllable by the design of the plates and linkage, and, of course, by the shape of the cam. Figure 2, p. 104, is a schematic diagram of the take-off and guide-plate mechanism.

The basic principle of the process is this: the rate of change of the tube diameter with respect to length and the ultimate dimensions achieved are controlled by forcing the air trapped inside the tube to move back and forth at various rates of speed, then quickly cooling the blown tube to fix the shape. The working details are as follows: the camshaft, *C*, can be adjusted right or left to accommodate gears of various diameters. The gear ratio of the spur gears on Shafts *B* and *C* can be calculated by comparing the circumference of Roll *A* with the length of the desired irregular shape. The support, *S*, may be moved vertically to provide some adjustment in reaching the shape for which the cam on Shaft *C* is designed, some slight modification of that shape. Refer for a moment to Fig. 3, p. 104, which shows a typical shape made in this process. If the Support *S* of Fig. 2 were shifted upward, the effect on the shape of Fig. 3 would be to in-

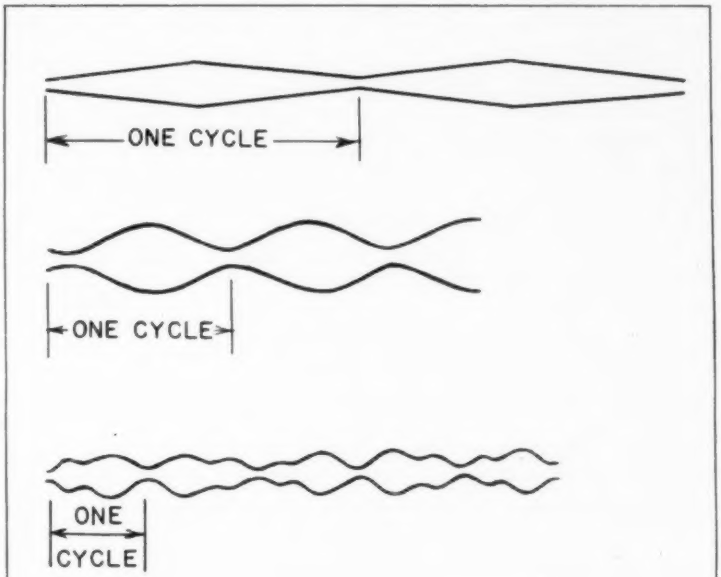

FIG. 1: Typical blown shapes that can be made by continuous "bulge" extrusion. Shape at top would be cut at widest and narrowest points and sealed along wide cut to make a narrow-mouth flask.

†Polymer Industrial Co., Ltd.
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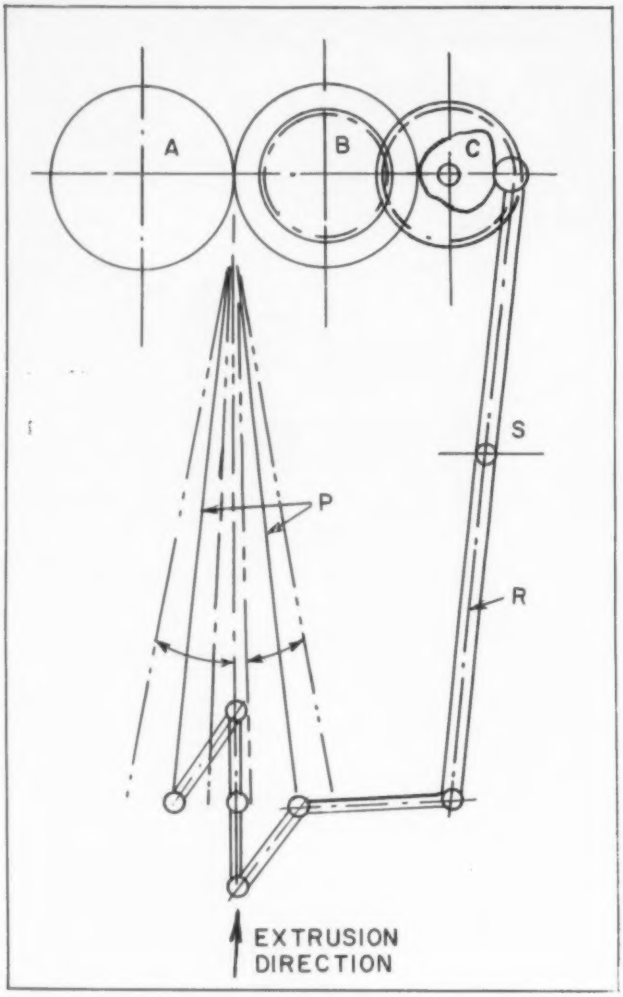

FIG. 2: End-view diagram of take-off and forming mechanism for continuous blow-forming of extruded tubing. **A** and **B** are take-up rolls. Roll **B** drives camshaft **C** through spur gears. Cam controls motion of Rod **R** and others and, through them, of the forming plates **P**. Extruded tube is drawn up from bottom through plates, which not only help control inflation but also provide cooling surface.

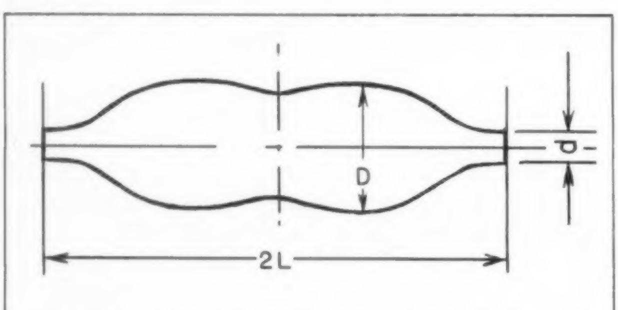

FIG. 3: This extrusion-blown shape was made in one cycle of mechanism shown in Fig. 2. Cut at mid-point and ends, it makes two clyster "bottles" that may be emptied by squeezing or pouring. Wall thickness of samples ranged from 5.5 mils at neck to 1.8 to 2.5 mils at Section **D**. Ratio D/d was about 3.8:1.

crease the diameter ratio D/d. However, if it were desired to *substantially* increase the diameter ratio, it would be best to increase the driving speed and to redesign the cam to cause the plates, P, to open earlier.

These changes would compensate for the greater delay in shifting the air enclosed in the tube that would be encountered if the support were shifted without modifying the cam and increasing the driving speed.

Problems, problems!

Although bulge extrusion has already enjoyed some success in the manufacture of suppository containers, there are serious problems that must be solved before it can hope for wide acceptance. One of these is the wrinkles that tend to form in the areas of fast-changing diameter during wind-up. Second is the problem of achieving a constant wall thickness throughout the entire tube. We do not believe that this problem can be solved by simply cycling the take-up speed so as to increase take-up rate when the narrow sections are being formed, decrease it when large-diameter regions are being formed. Another difficult problem is the achievement of high cooling rates. The chief limitation on the sharpness of changes in profile is rate of cooling, and this difficulty increases with increasing wall thickness. Finally, cycle-to-cycle reproducibility of dimensions is poor in comparison with the reproducibility achieved, say, in sheet thermoforming. It is not yet clear whether or not a high degree of reproducibility will be practicable in this process. In theory, at least, it should be possible.

It is important that the extruder output be matched to the capacity for cooling the inflated tubes. The shape shown in Fig. 3, for example, which is cut across at center and ends and sealed at the center cuts to form two containers holding about 4 fl. oz. each, is made with a 1- or 1¼-in. extruder at an output rate of about 4.5 lb./hr. It is clear that the aspect of this process most in need of improvement is the cooling of the inflated tube.—**End.**

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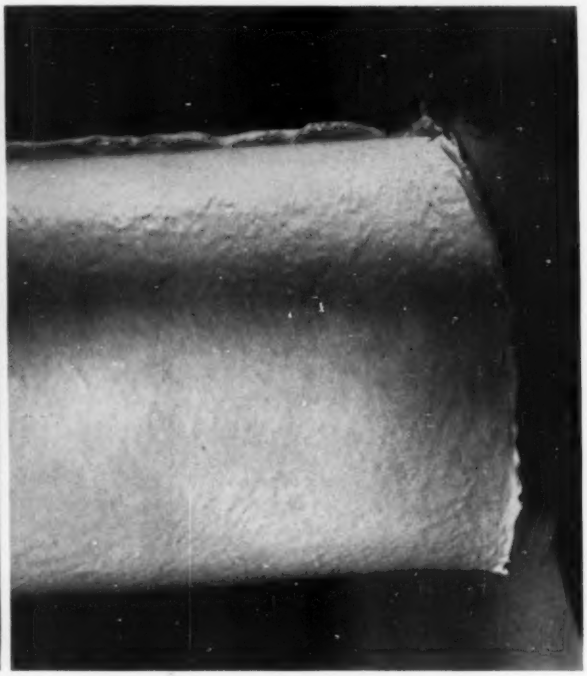

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PLASTICS* TECHNICAL SECTION

MATERIALS • PROPERTIES • TESTING METHODS AND INSTRUMENTATION • STANDARDS • CHEMISTRY

Gas transmission by plastics films

By W. E. Brown† and W. J. Sauber†

Apparatus that provides simplicity, sensitivity, speed, flexibility, and automation is described for the determination of rate of gas transmission by plastics films. For these reasons, it is considered to be a practical, useful instrument for the packager and the material supplier in day-to-day measurement of gas transmission without sacrificing the requirements of a good research and development tool. Data for typical gas transmission rates of plastics films are presented.

The transmission[1] of gases by plastics is particularly important in food packaging; the choice of plastic will affect the shelf life of the product directly. For example, extremely low oxygen permeability is desirable in packages for nuts, processed meats, and other fatty or oily foods to prevent oxidation and rancid taste. Conversely, high permeability plastics are needed in packages for vegetables that must breathe to maintain their freshness. Similarly, fresh meats need plenty of oxygen to keep their bright red color.

Gas transmission was studied as early as 1866 by Graham. His work dealing with the transfer of gases through rubber, shows that gas transmission is hardly a new problem. However, gas barrier materials available in Graham's time were far more permeable to gases than the present-day highly impermeable films such as saran, polyethylene terephthalate, saran-coated cellophanes, and others. Thus, the problem of measurement is more difficult now than before.

There are several ways of measuring the gas transmission rates of today's plastic molding materials and fabricated products: 1) thermal conductivity; 2) refractive index; 3) mass spectrometry; 4) gas analysis by chemical means; and 5) pressure-volume-temperature (PVT). For various reasons, mostly cost, all the foregoing methods, except the pressure-volume-temperature type, are impractical for day-to-day usage. As a result, the measurement of pressure, volume, and temperature of the transmitted gas has become the most popular procedure.[2] Even within the PVT type of determination, there are several modifications which are described below. Each of these has its special advantages or design features. Some of the earlier work with **(To page 110)**

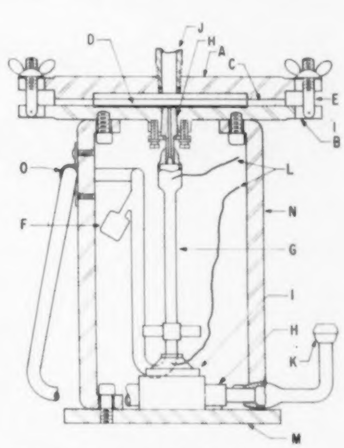

FIG. 1: Cross-sectional view of gas transmission apparatus. **A**—upper plate; **B**—lower plate; **C**—rubber gasket; **D**—porous filter paper with film to be tested over the paper; **E**—swivel bolts; **F**—mercury storage reservoir; **G**—calibrated portion of instrument; **H**—Kovar connection between steel and glass; **I**—Demi-G valve; **J**—freon tight tubing carrying gas to the film to be tested; **K**—vacuum pump attachment; **L**—lead wires to Brown recorder; **M**—base plate; **N**—stainless steel supporting legs; and **O**—the glass supporting clip.

*Reg. U. S. Pat. Off.

†Plastics Technical Service, The Dow Chemical Co.

[1]There are many references which quote "gas permeability rates, P," in a multiplicity of units. P is almost universally related to unit thickness. This is not always true of gas transmission rates and is not a recommended procedure in ASTM D 1434-56T. Otherwise, gas transmission rate is equivalent to gas permeability.

[2]Nonetheless, two interesting analytical methods have been recently treated in the literature and deserve mention here. Landrock and Proctor (7) approximated conditions prevailing in and around packages with a refined mixed-gas analysis method. Kirshenbaum and Streng (6) studied permeability of elastomers with radioactive carbon (C-14).

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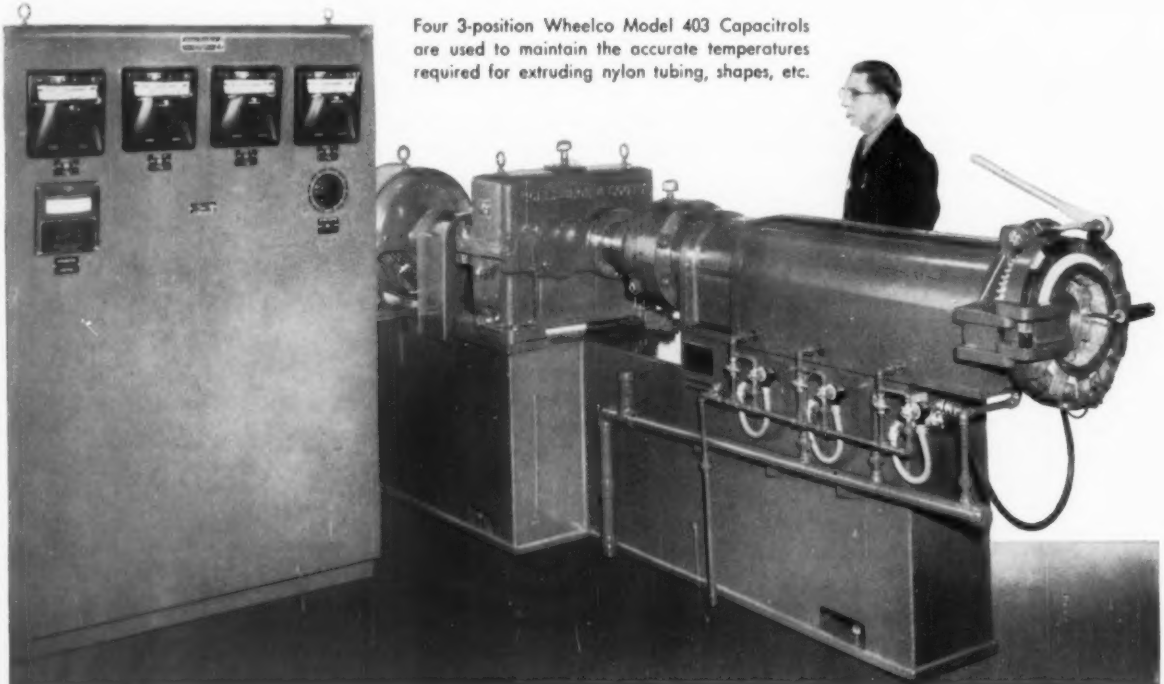

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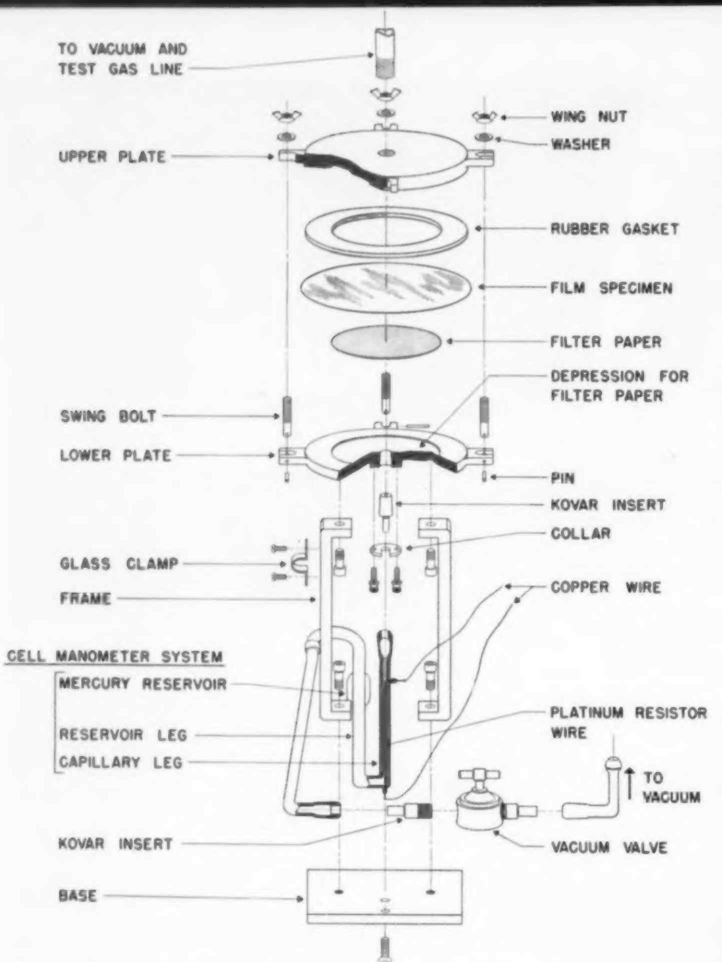

FIG. 2: Exploded view showing detailed construction of the cell.

synthetic polymeric films was reported by Elder (4).[3] He described a manometric system, subsequently called the General Foods cell, in which the test gas was continuously passed over the sample. The sample was supported over a glass manometer having a mercury-capillary center-tube.

In 1944, Shuman (12) described the same apparatus in greater detail claiming greater sensitivity and capability of measuring very low permeability constants.

Todd (15) pointed out that the method of Elder and Shuman permitted a decrease in pressure differential across the film from the start to the finish of the test, thereby resulting in a progressively lower transmission rate. Todd simply reversed the flow of gas in the manometer system. The gas was contained ahead of a column of liquid in a glass capillary. In addition, the transmitted gas was collected on the opposite side of the film in a large, initially-evacuated chamber.

Cartwright (3) produced a cell that was said to be six times more sensitive than previous instruments. He indicated that the movement of the liquid column in the Todd apparatus was affected by small changes in temperature and barometric pressure. Cartwright's cell was similar in principle to that of Elder and Shuman, consisting of glass components with ground-glass joints carefully fitted and lubricated.

Sarge (10) extended the sensitivity of a manometer-type cell down to a range suitable for measuring gas transmission rates of extremely slow-transmitting polymers such as saran. This device also was similar in principle to the Elder-Shuman cell, but had the additional advantage of greater sensitivity at low transmission rates and greater structural durability.

Brubaker and Kammermeyer (1, 2) developed a rugged apparatus which they claimed to be insensitive to leaks and independent of precise regulation of gas flow. These authors showed that rapid measurements could be made of helium and hydrogen transmission through a series of selected polymeric films. Park (9) designed a semimicro unit on similar principles.

More recently, Stannett, Szwarc, and co-workers (5, 13, 17) published several papers on the permeability and diffusion rates of a variety of gases and vapors through a variety of films and coated papers. Their technique leads to basic, absolute data by virtue of the design of the equipment and the method of operation. Essentially, it is a pressure-volume-temperature method in which gas is introduced at relatively high pressures on one side of the film and allowed to permeate to an evacuated, large-volume, low-

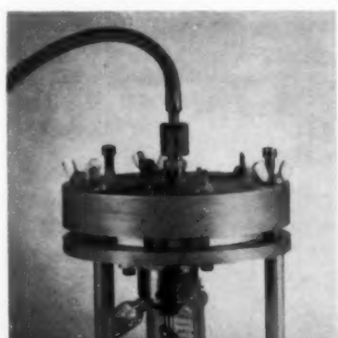

FIG. 3: This is the presently-used Dow gas transmission cell. It differs slightly in design from the one shown in the cross-sectional (Fig. 1) and exploded (Fig. 2) views in that the upper plate has been modified so that an O-ring gasket could be used to isolate the specimen from the atmosphere. In addition, the position of the vacuum valve has been changed to keep spillage of mercury into the mechanism to a mimimum.

[3]Numbers in parentheses link to references at end of article, p. 116.

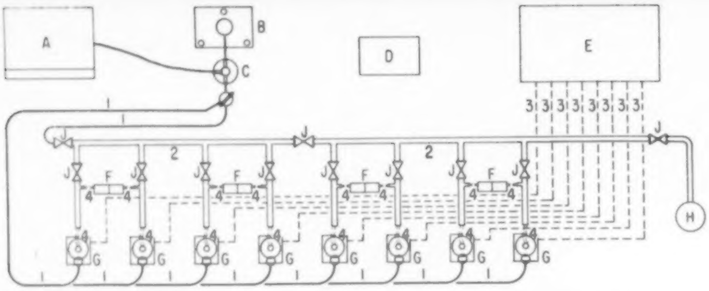

FIG. 4: Schematic view of an 8-cell multiple automatic gas transmission unit. Very little attention is required as soon as the determination is started and simultaneous determinations can be made on a variety of specimen-gas combinations. **A**—Welch duo seal vacuum pump; **B**—Du Brovin vacuum gage—to measure vacuum in cell; **C**—trap; **D**—barometer; **E**—Brown 8-point automatic recorder; **F**—mercury manometers—to measure pressure on gas side of membrane; **G**—gas transmission cells; **H**—gas cylinders; **J**—special freon tight valves; **1**—single solid lines indicate rubber tubing; **2**—double lines indicate copper tubing; **3**—dotted lines indicate electrical wiring; **4**—double dotted lines indicate freon tight tubing.

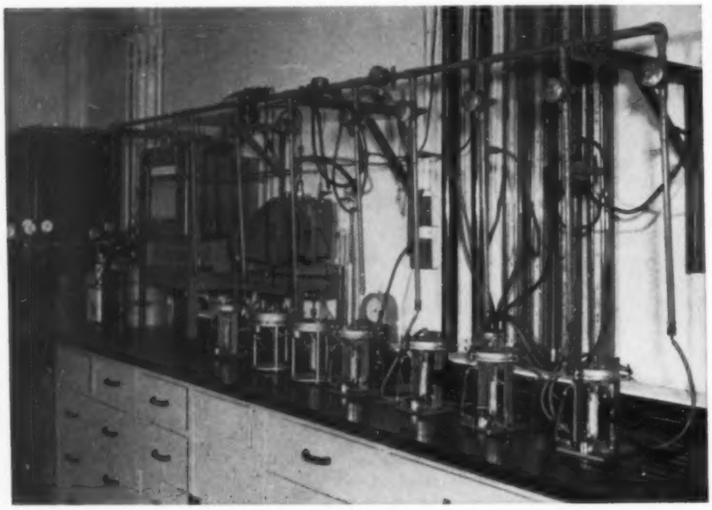

FIG. 5: The multiple automatic unit described in Fig. 4.

pressure, measuring system on the other side of the film. Volatile components which may be emitted from the film are condensed to prevent interference with calculation of the true gas transmission rate. The relatively long time required for a determination and the relatively high cost per cell makes this method less desirable for industrial service although it has great value in research.

Description of apparatus

Essentially, features of many of the above described PVT cells have been borrowed, combined, and further modified to produce a unit that: 1) provides an accurate measure of the transmission rate of films, sheets, and molded specimens; 2) permits determinations of extremely low to extremely high transmission rates; 3) incorporates automatic recording to make the unit essentially self-operating; 4) provides for rapid determinations regardless of transmission rate; 5) provides a rugged design suitable for the industrial laboratory; 6) requires no highly specialized operating skills; and 7) allows adaptation to a multi-cell system.

Such an instrument has been designed and adopted by the American Society for Testing Materials Committee D-20 as the preferred method of ASTM D 1434-56T "Tentative Method of Test for Gas Transmission Rate of Plastic Sheeting." A cross-sectional view, an exploded view, and a photograph of the cell are shown in Fig. 1, p. 107; Fig. 2, p. 110; and Fig. 3, p. 110, respectively.

Operation of apparatus

Prior to admission of the test gas, evacuation to less than 0.2 mm. of mercury pressure on both the high and low pressure sides of the cell is completed. After the cell manometer system has been evacuated, mercury is dumped from the reservoir into the manometer legs. A relatively large volume of gas is admitted from the high pressure side of the cell to the specimen (which may be a film, sheet, or laminate) clamped between the upper and lower plates. The underside of the specimen is supported by filter paper to facilitate collection of the test gas. The specimen test area is defined by the upper and lower clamping plates, a gasket, and the filter paper. With a pressure differential existing across the specimen, gas will be transmitted. After passing through the specimen the gas is collected in the cell manometer system. As the pressure of the transmitted gas rises in the manometer, the mercury level in the capillary leg falls and the excess mercury spills into the reservoir, thus maintaining a constant head in the stationary leg. The pressure on the low pressure side increases from zero to some finite value.

It now remains only to measure the pressure rise in the manometer

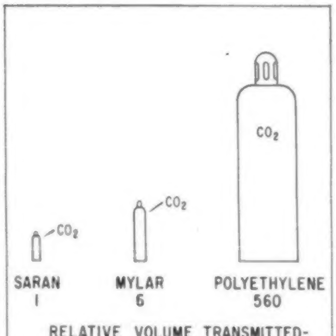

FIG. 6: Gas transmission of films varies greatly. Gas transmission rates are depicted here as gas cylinders of a size required to hold the relative amounts of gas that were transmitted.

system as a function of time. A pressure-time curve may be obtained visually with the help of a cathetometer, or instrumentally with an autographic electrical resistance recorder.[4] The latter method is more convenient in operating the eight-cell system shown in Figs. 4 and 5. The pressure in the vacuum system and the pressures of the test gases are measured with a Du Brovin gage and 2-atmosphere manometers, respectively. Atmospheric pressure is measured with a recording barometer. The mercury height is plotted automatically with an eight-point recorder connected, as mentioned in footnote 4, to platinum resistance wires in each of the cell manometer systems.

A vacuum pump connected to each cell through appropriate piping is needed to evacuate the system above the specimen. The cell manometers may be evacuated individually through rubber tubing from the vacuum system to any one of the cells. Any of a number of gases may be admitted to the high pressure side of a cell. A different gas may be admitted to each cell or combination of cells.

[4]A fine platinum wire is inserted through the center of the capillary leg with exterior connections leading to a recorder. The mercury shorts out the resistance wire and, through falling, yields a resistance change proportional to the height of the mercury.

[5]The calibration for a given cell would normally be supplied by the manufacturer.

Calculations

Gas transmission rate calculations involve simple multiplication and division of four quantities: 1) the cell constant; 2) the rate of change of the transmitted gas pressure (mercury height in the cell); 3) the gas conversion constant; and 4) the differential pressure across the film. (See p. 114 for complete derivation of equation used in the calculation of gas transmission rates.)

Cell constant: Most authors in the past have treated the calculation of gas transmission rates as the simple relationship, PV = nRT. In a determination of this nature, both the pressure of the transmitted gas and the volume that it occupies increase simultaneously but not at the same rate throughout the test. Therefore, these two variables must be treated in a differential equation. Based on the ideal gas law, a fairly simple derivation of the cell constant is:

$$\text{Cell constant} = \frac{2\,ah - a\,(h_L + h_B) - V_f}{A}$$

where a = area of capillary; h = height of Hg in cell capillary leg; h_L = height of Hg in cell reservoir leg; h_B = height of capillary (cell manometer leg) from datum plane to B; $V_f = V_{BC} + V_{CD}$ = total void volume from top of Hg cell capillary leg (B) to base of specimen; and A = area of transmission.

This constant is dependent only on the geometry of the cell, including film area, cell volume, and mercury height. It varies with the height of mercury in the manometer, but is linear with mercury height and thus can be shown as a straight line.[5]

Rate of change of the transmitted gas pressure: This rate corresponds to the change in height of mercury in the cell manometer with time which may be read visually in millimeters per hour or recorded autographically on a strip chart. In the latter case, the rate of change of pressure, dh/dt, is the recorder travel constant (or the rate at which the recorder pen moves with change in cell manometer height) times the rate of paper travel divided by the slope of the recorded curve.

Gas conversion constant: An appropriate gas constant depending upon the units desired to report gas transmission rate is used. *T* is normally reported as the absolute temperature in degrees Kelvin.

Differential pressure across the

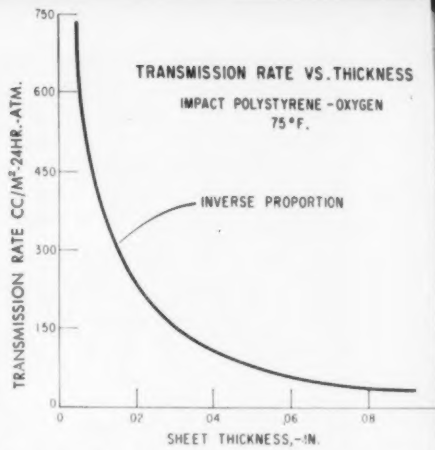

FIG. 7: Gas transmission rate is normally inversely proportional to specimen thickness. This rule may be used especially to compare films 1 to 5 mils thick, the range for many commercially available materials, and sheets whose thicknesses do not differ by a great amount.

Table I: Typical gas transmission rates of plastics films at 23° C.[a,b]

Plastic film	*Gas transmission rates in cc./m.²-24 hr.-1 atm.*[c] O_2	N_2	CO_2
Cellulose acetate	350	1500	7800
Methylcellulose	1300	450	6800
Polyethylene			
0.917 density	2700		
0.950 density	1700		
0.960 density	1600	440	
Polyethylene terephthalate	50	8.4	240
Polystyrene	4500	640	11,000
Polyvinyl chloride, plasticized	190-3100	53-810	430-19,000
Polyvinyl chloride, rigid	120	20	320
Polyvinyltoluene	5700	1200	17,000
Rubber hydrochloride	390	62	1100
Saran	16	2.5	50
Styrene-acrylonitrile copolymer	900	120	2800

[a]Gas transmission rates depend especially upon composition of the film and, therefore, will vary with plasticizer type and content, molecular weight, molecular weight distribution, branching, and so forth. Thus, these rates must be considered only typical of a given film class.

[b]These rates were determined with dried gases. Moisture-sensitive films and those films that readily absorb water or water vapor usually exhibit gas transmission rates many times higher in the moist condition or in a moist gas atmosphere.

[c]Determined in accordance with ASTM method D 1434-56T; all films were 0.001-in. thick.

film: Our final consideration is the driving force of the gas. The differential pressure is simply the test gas pressure minus the cell pressure, $P-P_t$. As shown previously, the test gas pressure, P_t, is read conveniently from a manometer.

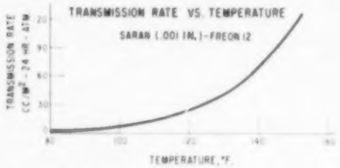

FIG. 8: As shown by this rectilinear plot, gas transmission rate of a film may vary with temperature.

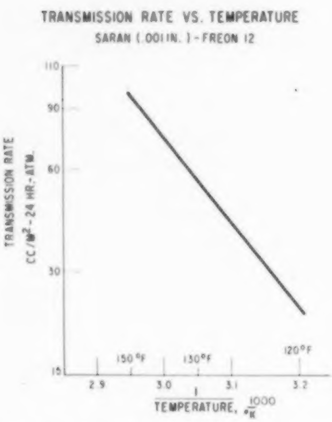

FIG. 9: The data in Fig. 8 have been plotted to produce a straight line. In regions where gases are perfect or nearly so, only 2 points are needed to determine the permeability rate over a wide range of temperatures. Three or four points are preferred, of course, to verify the slope, particularly as new materials are investigated.

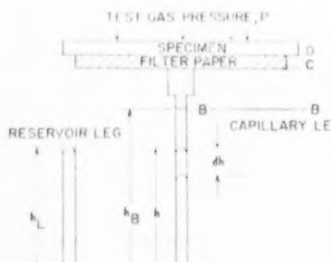

FIG. 10: Diagram of the system.

The internal cell pressure, P, is the height of mercury in the cell manometer.

Review of gas transmission data

As mentioned previously, plastics are often chosen as packaging mediums primarily for their ability to permit or prohibit the transmission of certain gases. Various plastic-gas combinations show widely varying gas transmission rates (Table I, p. 113). Figure 6, p. 112, depicts the transmission rates of three films—saran, Mylar[6], and polyethylene—as containers of a size required to hold the relative volumes of gas transmitted by specimens of equal area and thickness. Measurements of these extremes are possible with the previously described cell through varying the chart speed, the specimen test area, and the pressure of test gas applied on the film.[7]

Gas transmission rate is inversely proportional to specimen thickness as shown in the plot of oxygen transmission rate for various thicknesses of modified (impact grade) polystyrene sheet (Fig. 7, p. 113). This general rule is especially helpful in comparing films up to 0.005 in. thick, the range for many commercially available materials.

Gas transmission rates vary significantly with temperature. As shown in the rectilinear plot (Fig. 8, left), the transmission rate of saran increases rapidly with temperature of the transmitting gas. These same data plotted as the logarithm of the transmission rate against the inverse of the absolute temperature produce a characteristic straight line[8] (Fig. 9, left) derivable from the basic Arrhenius rate process relation:

$$\bar{P} = \bar{P}_o e^{-E/RT}$$

$$\text{as} \quad \log \bar{P} = \log \bar{P}_o - \frac{E}{RT} \log e$$

For perfect gases only two points are needed to determine the transmission rate over a wide temperature range.[9] However, where the gas approaches its condensation point, the rate may unpredictably waver and even go up as lower temperatures are reached (13).

It has been shown that the gas *volume* transmitted through a film is directly proportional to the pressure across it; thus the *rate*, which accounts for pressure, remains the same. A sampling of data (Table II, p. 116) shows that a constant rate is maintained for each gas (air, oxygen, or nitrogen) even though the pressure differential is varied. It is expected this will hold true only below those (high) pressures that cause distortion of the film.

Data from the literature (Table III, p. 116) were compared with those obtained with this cell. Good agreement was found when comparisons were made with data obtained by Stannett (14), Van Amerongen (16), and Brubaker and Kammermeyer (1, 2), which are believed to be among the most reliable published. Higher test temperatures no doubt account for the slightly higher rates reported by the latter authors.

Derivation of equation

The symbols (see Fig. 10, left) used in the derivation of the equation for the calculation of gas transmission rates are as follows:

- a = cross-sectional area of capillary AB, in square millimeters,
- R = universal gas-constant, 6.24×10^7 (cu. mm. $\times$ mm.)/(° K. $\times$ g.-mole)
- T = absolute temperature, in degrees Kelvin,
- n = quantity of gas transmitted, in moles,

---

[6]Du Pont brand of polyester film.

[7]The cell may also be provided with inserts to change the void volume, and, therefore, the sensitivity.

[8]Othmer and Frohlick (8) described a unique method of correlating and plotting permeability constants of gases through plastic membranes at various temperatures as log $\bar{P}$ versus a temperature scale derived from the vapor pressures of a reference liquid. The relationship:

$$\log \bar{P} = \left(\frac{E^* - \Delta H}{L} \right) \log p + C$$

where

- $\bar{P}$ = permeability constant,
- E^* = energy of activation for diffusion,
- ΔH = heat of solution of the gas in the polymer membrane,
- L = molar latent heat of reference liquid,
- p = vapor pressure of reference liquid, and
- C = a constant.

on which the method of plotting is based, yields a linear plot. Further treatment yields a nomogram in which a vast amount of data on various film—gas combinations can be plotted.

[9]It is much safer, of course, to verify such a relation with two or three additional points.

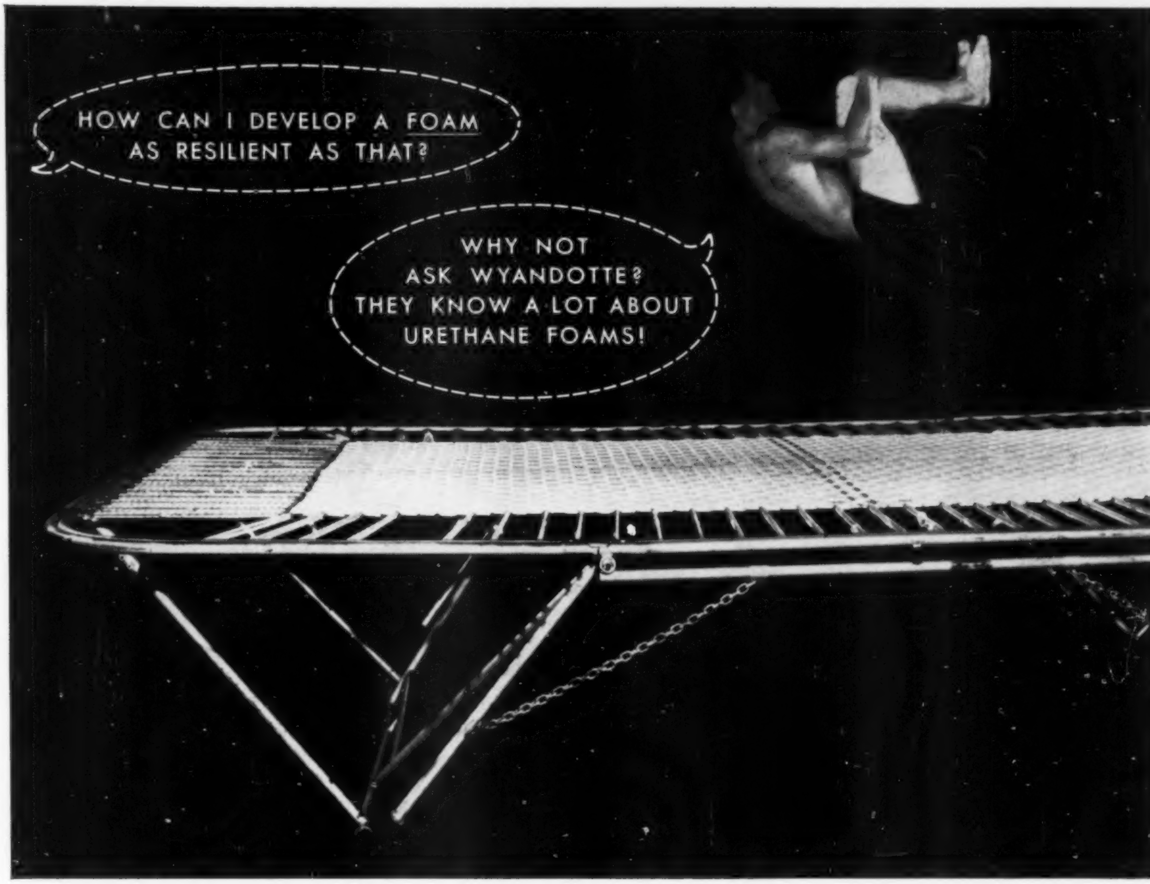

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Table II: Transmission rate independent of pressure differential. Data for 2-mil polystyrene film at 23° C.

Gas pressure differential	*Transmission rate cc./m.²-24 hr.-atm.*
Air	
1 atm.	450
2 atm.	450
Oxygen	
½ atm.	2320
1 atm.	2310
Nitrogen	
1 atm.	240
2 atm.	250

t = time, in hours,
A = area of transmission, in square centimeters,
V_{CD} = void volume of depression, in cubic millimeters,
V_{BC} = volume from B to C, in cubic millimeters,
V_f = $V_{BC} + V_{CD}$, in cubic millimeters,
V_t = volume of transmitted gas, in cubic millimeters = $V_f + a(h_B - h)$,
dP = −dh = differential pressure change of transmitted gas, in millimeters of mercury,
dV = −adh = differential volume change of transmitted gas, in cubic millimeters,
P = pressure of gas to be transmitted, in millimeters of mercury,
P_t = $h_L - h$ = pressure of transmitted gas, in millimeters of mercury,
Pd = $P - P_t$ = driving force, in millimeters of mercury.

The number of moles of gas transmitted, n, may be determined from the ideal gas law (which is valid at the low pressure involved) as:

$$n = \frac{P_t V_t}{RT}$$

Or, for differential changes in P_t and V_t:

$$dn = \frac{P_t dV + V_t dP}{RT}$$

Substituting:

$$dn = \frac{-aP_t dh - V_t dh}{RT} =$$

$$dh\left[\frac{2ah - a(h_L + h_B) - V_f}{RT}\right]$$

Since the transmission rate is given by

$$\text{Rate} = \frac{dn}{dt}$$

and since the transmission rate must be reported per unit area, then *A*, the area of transmission, may be included here and the above equation for dn rewritten as:

$$\frac{dn}{dt} = \frac{dh}{dt}\left[\frac{2ah - a(h_L + h_B) - V_f}{A}\right]\frac{1}{RT}$$

The expression in brackets is the *cell constant.*

The gas constant, *R*, and *T* are known at a given temperature. Thus, dn/dt reduces to dh/dt, which is determined experimentally, multiplied by two constants.

For determinations using a cathetometer: dh/dt = slope of the graph, where *h* is in millimeters and *t* is in hours.

For determinations using an electrical resistance recorder: dh/dt = (recorder travel constant × rate of paper travel)/(slope). The recorder travel constant and the rate of paper travel are determined by calibration in millimeters per inch and inches per hour, respectively. Slope in this case is dimensionless.

Since the gas transmission rate is to be reported as cubic centimeters per square meter per 24 hr. per atmosphere at standard temperature and pressure °C., 1 atmosphere), dn/dt may be converted:

$$\text{Gas transmission rate} = \frac{dn}{dt} \times \frac{(22{,}415 \text{ cu. cm.})}{(\text{mole})} \times \frac{10{,}000 \text{ sq. cm.}}{\text{sq. m.}} \times \frac{760 \text{ mm.}}{\text{atm. press.}} \times \frac{(24)}{(P - P_t)}$$

$$= \frac{dn}{dt}\,\frac{4.08 \times 10^{12}}{(P - P_t)}$$

$$= \frac{dh}{dt}\,(\text{cell constant}) \times \frac{4.08 \times 10^{12}}{(P - P_t)}$$

Acknowledgments

It is a pleasure to acknowledge the assistance of J. E. Ritzer of the Glass Fabrication Laboratory, The Dow Chemical Co., in the development of this cell, and of Dr. Turner Alfrey, Polymer Research Laboratory, The Dow Chemical Co., in describing the mathematical relationships. The authors also thank Mr. T. D. Mecca, Yerkes Research Laboratory, E. I. du Pont de Nemours and Co., until recently chairman of the Gas Permeability Section of ASTM Committee D-20, for his helpful review of this paper.

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(To page 190)

Table III: Comparison of data

Film and gas	*Gas transmission rate in cc./m.²-24 hr.-atm.* ASTM D 1434-56T Cell (23° C.)	Literature values (30° C.)
Saran		
Oxygen	16	13
Nitrogen	2.5	2.5
Mylar[a]		
Oxygen	50	57
Nitrogen	8.4	13

[a]Du Pont brand of polyester film.

Ultraviolet absorbers for plastics

By R. A. Coleman* and J. A. Weicksel†

In sunlight as it reaches the earth on a clear June day, there is a continuous spectrum of wavelengths ranging from 300 to 5000 mμ. That portion of sunlight visible to the eye as white light extends from 400 to 700 mμ and represents close to half (45%) of sunlight. Light wavelengths longer than 700 mμ are found in the invisible infra-red region. The shorter wavelengths (between 300 and 400 mμ) are also invisible and are known as ultraviolet light. Only about 5% of the total sunlight at the earth's surface falls in this category (1).[1]

Light, of course, is radiant energy. As shown in Fig. 1, below, the intensity of its energy varies inversely with its wavelength (2). The shortest waves, i.e., the ultraviolet, have the highest energy. The energy required to break a bond between the atoms in a molecule generally ranges from 50 to 100 kcal./mole (Fig. 1). The energy of ultraviolet light, 82 kcal./mole at 350 mμ, is sufficiently strong to break apart many molecular bonds of organic substances.

Only when ultraviolet energy is partly or wholly absorbed, however, can it cause photochemical reactions that result in product degradation (3). When a molecule absorbs ultraviolet energy, it becomes highly activated or electronically excited. These excited molecules usually are unstable and remain in this state only a very short time, frequently less than a ten-billionth of a second.

While in the excited state, a molecule may act in one or more of several ways. Each results in a loss of the ultraviolet energy absorbed and a return to an unexcited state. The excited molecule, for example, may transfer its absorbed energy to another molecule during collision. It may release its borrowed ultraviolet energy by re-emitting at longer wavelengths. The released energy manifests itself in such phenomena as fluorescence, phosphorescence, or heat.

More important to the problem of ultraviolet degradation is a third action in which the energy absorbed initiates a photochemical reaction. Under such stimulus, the activated molecule may react with itself or with neighboring molecules.

Such photochemical reactions may be postponed effectively or even prevented entirely by incorporating an ultraviolet-absorbing compound into ultraviolet-sensitive materials. Ultraviolet absorbers protect plastics by preferentially absorbing the destructive, high-energy ultraviolet and re-emitting this energy at nondestructive wavelengths. Strong absorption throughout the entire ultraviolet region of 300 to 400 mμ is a primary prerequisite. In addition to absorbing and transforming ultraviolet energy, these absorbers must have other important properties to be of practical use (2). These include light stability, low color, good compatibility, heat stability, low volatility, and chemical stability.

The increasing use of plastics as wrappers and containers for foods makes non-extractibility and/or non-toxicity of additives essential properties in such applications. If an absorber is not extracted and/or not toxic and has the properties named, it may find use in packaging films.

Commercial UV absorbers

Ultraviolet absorbers that are available commercially today can be classified by chemical struc-

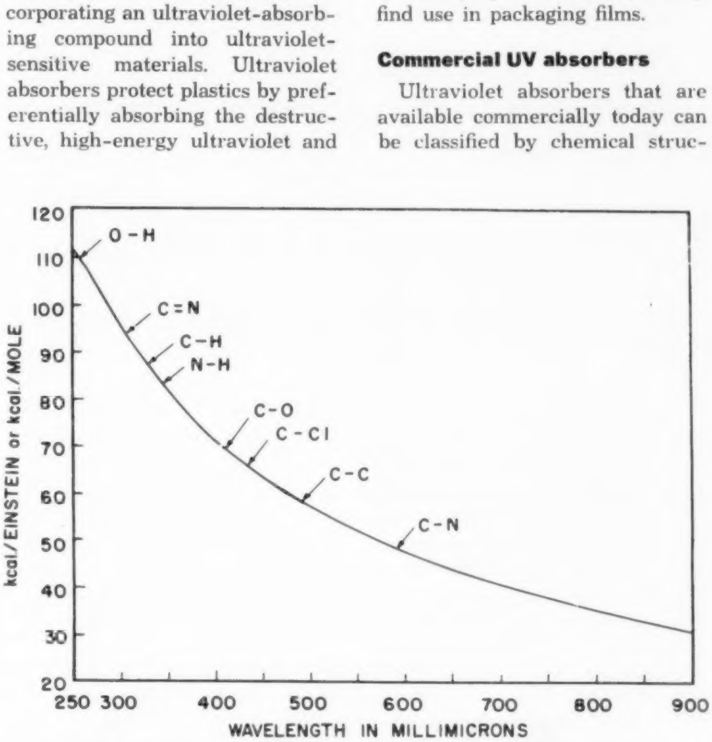

FIG. 1: Energy curve for ultraviolet light. Solid curve converts ultraviolet wavelengths into kilocalories per Einstein. (Einstein is Avogadro's number of photons.) Energies of bonds given in kilocalories per mole.

*Research Laboratories, American Cyanamid Co., and †Product Supervisor for Cyasorbs UV absorbers, American Cyanamid Co.

[1]Numbers in parentheses link to references at end of article, p. 198.

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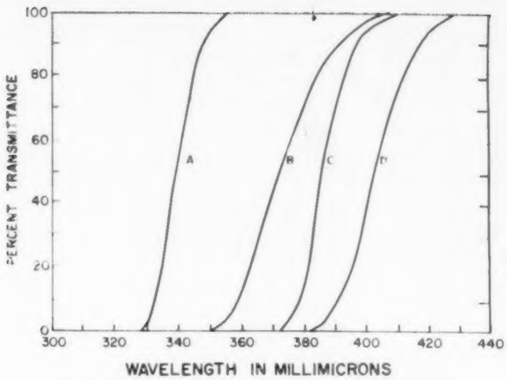


FIG. 2: Transmittance curves for 1.0 cm. cell samples of solutions of four ultraviolet absorbers in toluene. Solution concentrations are 100 mg. absorber per liter of toluene. **A:** phenyl salicylate; **B:** 2-hydroxy-4-methoxy-benzophenone; **C:** substituted benzotriazole; **D:** D-2,2'-dihydroxy-4-methoxybenzophenone.

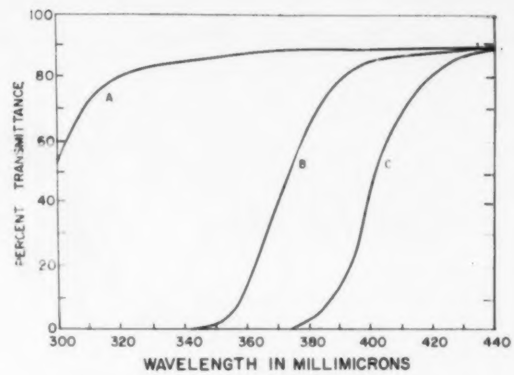
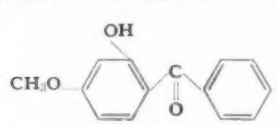


FIG. 3: Effectiveness of absorbers in thin films. The film used is 12-mil cellulose acetate. Curve **A:** without absorber; Curve **B:** with 0.3% 2-hydroxy-4-methoxybenzophenone; Curve **C:** with 0.55% 2,2'-dihydroxy-4-methoxybenzophenone.

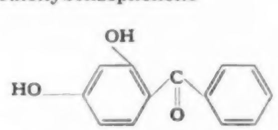
tures as salicylic esters, hydroxybenzophenones, and benzotriazoles. Transmission curves for phenyl salicylate, 2-hydroxy-4-methoxybenzophenone, substituted benzotriazole, and 2,2'-dihydroxy-4-methoxybenzophenone are shown in Fig. 2, above.

The phenyl and *p*-tertiary-butyl esters of salicylic acid are colorless and absorb below 340 mμ. Although they protect against this portion of ultraviolet light, they do not offer any protection to the energy above 340 mμ.

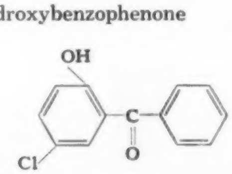
The hydroxybenzophenones are divided into two classes: the 2-hydroxy- and the 2,2'-dihydroxybenzophenones. The 2-hydroxybenzophenones usually have little color and the ability to stabilize plastics to light below 370 mμ. Commercially available compounds of this type are:



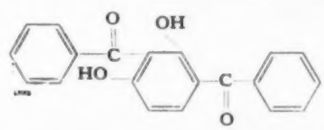
2-hydroxy-4-methoxybenzophenone



2,4-dihydroxybenzophenone

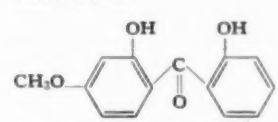


5-chloro-2-hydroxybenzophenone

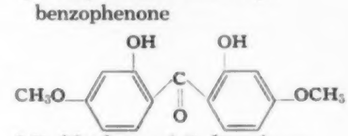


A mixture of 3-benzoyl- and 5-benzoyl-2,4-dihydroxybenzophenone

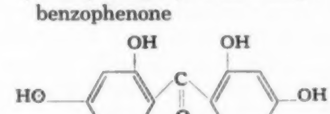
The 2,2'-dihydroxybenzophenones are the strongest absorbers (Fig. 2). They absorb light effectively over the entire ultraviolet region (300 to 400 mμ.). Because their absorption overlaps slightly into the visible spectrum, they have a slightly yellow color, which is considered to be the limit of yellowness permitted in a general-purpose compound. The chemical types available on the market are:



2,2'-dihydroxy-4-methoxybenzophenone



2,2'-dihydroxy-4,4'-dimethoxybenzophenone



2,2',4,4'-tetrahydroxybenzophenone

Other chemical compounds have been mentioned in patents or offered for trial. The list of these chemical types is extensive and includes such compounds as heterocyclics, azines, and nitro derivatives. At this time, however, most of these products have not exhibited a stability to light equal to that of the benzophenones and salicylic esters. For this reason, only absorbers with these two chemical structures have satisfied any great demand.

Concentration needed

The amount of an absorber required to provide economical protection in a plastic is governed by several factors: 1) thickness of the plastic; 2) tolerance of color; 3) added cost of ultraviolet absorber; and 4) effect of high concentrations of absorber in plastics. Other factors such as compatibility of the absorber in the plastic and ultraviolet-light sensitivity of the plastic may dictate a decrease or increase, respectively, in the amount of absorber used. Optimum protection with minimum side effects must always be determined for each individual application. The hydroxybenzophenones, for example, have good heat stability and fair to very good compatibility in most plastics. In such amine-type resins as nylon, urea, and melamine, however, we find that hydroxybenzophenones become yellower in color.

Because they are chemically inert, they usually do not affect

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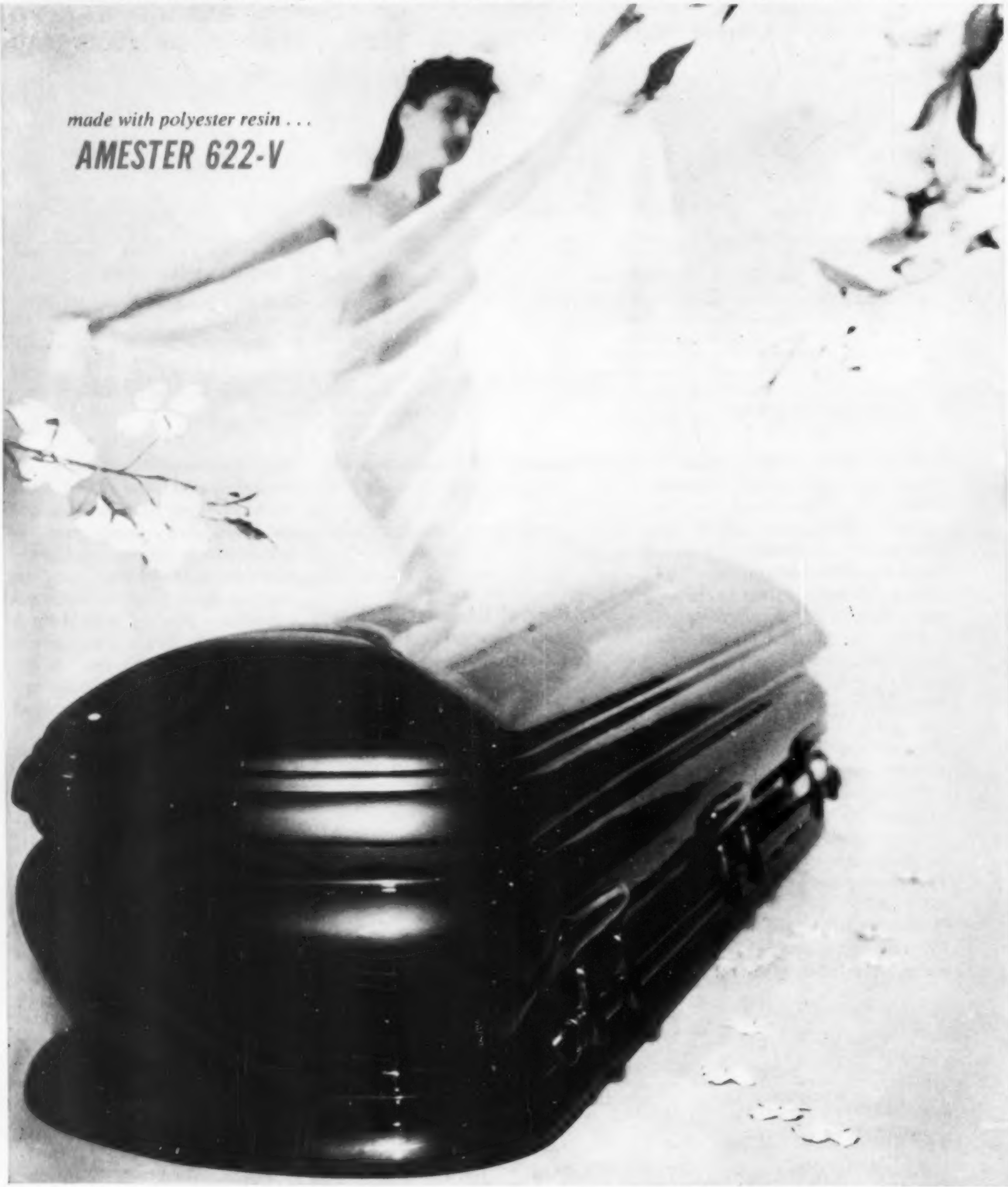

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In general, the concentration required is a function of the thickness of the plastic. The thinner the plastic, the higher will be the concentration of ultraviolet absorber necessary for adequate protection. The effect of light is greatest on the surface of a plastic. In a thin film, the surface layer is a much larger fraction of the total film than it is for a thick film and, therefore, plays a more important role in the total properties of the thin film.

The effectiveness of absorbers in thin films is shown in Fig. 3, p. 119. Film *B* filters out 80% of the ultraviolet and has very little color, as shown by the flatness of the curve at wavelengths longer than 400 mμ. Monohydroxybenzophenones are suitable for making this film or ultraviolet-filtering screen.

Film *C* screens out 95% of the ultraviolet, but has a faint color that is caused by some absorption in the visible range. This color is very often tolerable or can be neutralized, as mentioned before, by a blue dye. The dihydroxybenzophenones provide this degree of protection.

To produce an ultraviolet-absorbing screen that has an identical spectrophotometric curve to that of Film *B* or *C* requires a definite amount of ultraviolet absorber to intercept the light. Once a suitable screen has been made and its absorber concentration and thickness have been determined, equivalent screens of the same materials can be made in varying thicknesses by decreasing the absorber concentration as the film thickness increases. For example, a 1-mil film with 2% ultraviolet absorber will give the same photometric curve as a 2-mil film of the same plastic with 1% of the same absorber or a 4-mil film of the same material with 0.5% of the same absorber. For a given curve, therefore, the product of concentration and thickness is a constant for a given plastic (4).

Incorporation in plastics

Most ultraviolet absorbers are easily incorporated into plastics. They can be added on a hot mill or in a Banbury. Their rate of dispersion is similar to that of oil-soluble dyes in plastics. The lower-melting absorbers are especially easy to disperse in this manner.

In compositions that contain plasticizers, dissolving the absorber in the plasticizer is often a more convenient method of addition, and insures complete dispersion of the absorber. Other methods of addition include distributing or dry-blending the absorber on the resin powder or granules before processing. In a few cases, ultraviolet absorbers may be applied to finished articles from a nonaqueous solution or from an emulsion.

Ultraviolet absorbers are more effective in clear, transparent plastics than in opaque plastics. Since light penetrates only a short distance into opaque plastics, any degradation by ultraviolet light is necessarily close to the surface. For an absorber to provide the best protection, therefore, its highest concentration should be in this surface volume of light penetration. In hand lay-up applications, this ideal construction is achieved by incorporating the ultraviolet absorber in the gel coat. In other current molding operations, however, the amount of absorber used is distributed evenly throughout the entire mass of an opaque plastic. The protection possible from the absorber, therefore, is at a lower level than that for clear plastics.

Even in some clear plastic applications, absorber concentration at the initial surface of the material may not be great enough to provide effective screening action (5). Such surface effects as loss of gloss may occur.

Applications in plastics

When incorporated directly into plastics, ultraviolet absorbers substantially improve their light stability. Spotting of plasticized polyvinyl chloride by sunlight is greatly delayed by ultraviolet absorbers (4, 6, 7). Polyvinylidene chlorides are similarly protected (8). From 0.5 to 1.0% of the monohydroxybenzophenones or from 0.1 to 0.2% of the dihydroxybenzophenones have been found to be effective in vinyl formulations. For vinyl films as thin as 1 to 15 mils, higher absorber concentration may be necessary to provide satisfactory protection and screening.

In reinforced polyesters being used in outdoor construction, ultraviolet absorbers have dramatically increased the useful life of this plastic material (9). Concentrations as low as 0.2 to 0.4% of monohydroxybenzophenones inhibit resin yellowing. Polyesters are degraded principally by the 325 to 330 mμ por- **(To page 198)**

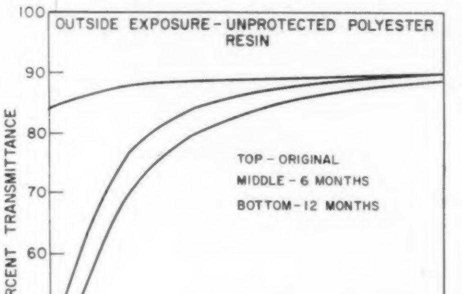


FIG. 4: Effect of ultraviolet light on clear, unprotected polyester resin.

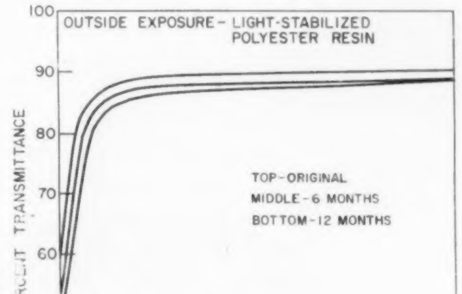
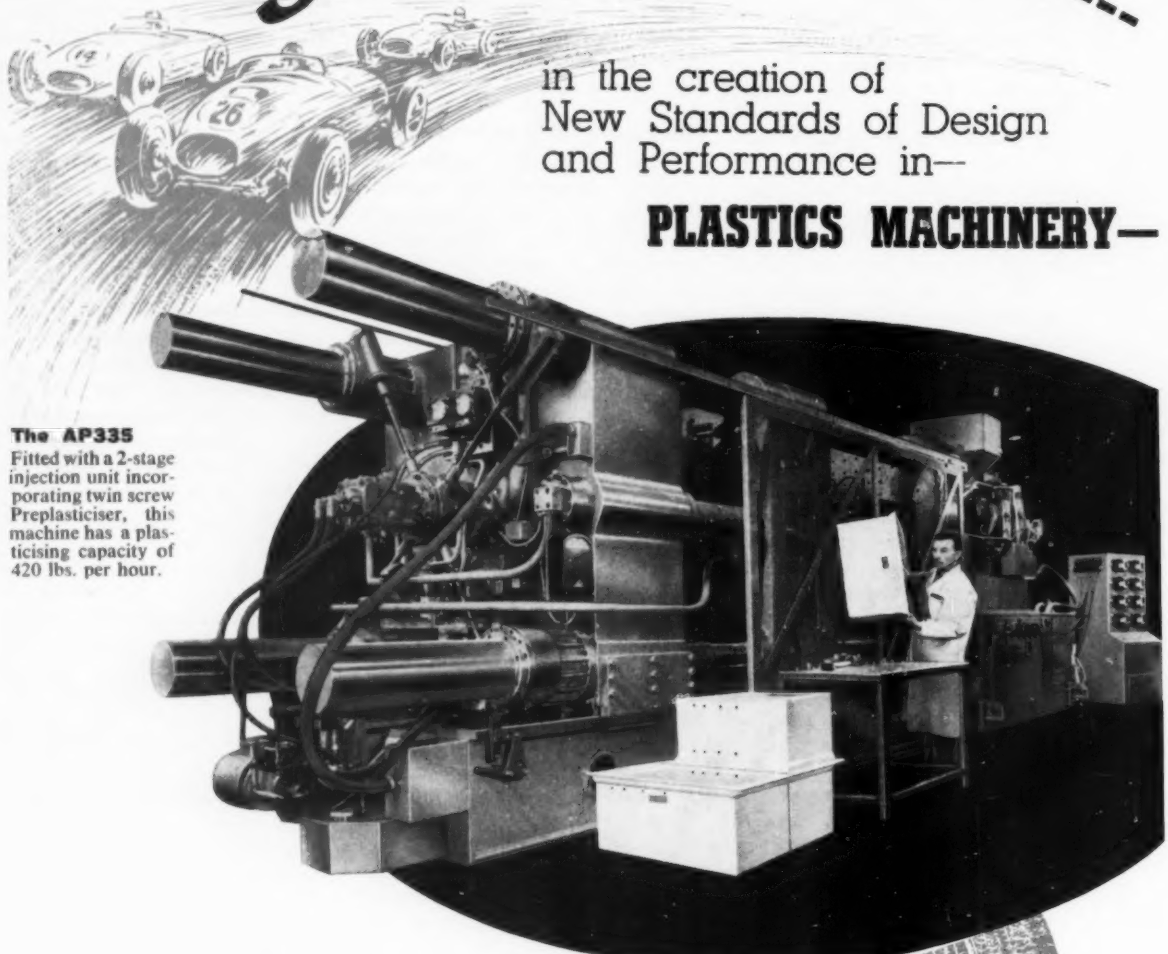


FIG. 5: Effect of ultraviolet light on clear, light-stabilized polyester resin containing 0.25% 2-hydroxy-4-methoxy-benzophenone.

Setting the Pace...



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Emphasis at the show will be on new materials and new processing techniques. The stereo-specific polymers, tailor-made to have the exact properties desired, will receive considerable attention, as will the urethanes, the polycarbonates, and the more exotic heat-resistant resins for use with reinforcement.

In processing equipment, attention will be given to screw or extruder plastication for injection molding, new automatic vacuum and drape forming machines, new approaches to extrusion molding, new devices for production of foams, new embossing and printing equipment, advanced compression units.

The show will be truly international in scope and interest, with all the free world represented in exhibits and attendance. Germany's rapid progress and expansion in plastics in the past five years has been watched closely by plastics' industries in all countries, as has her development of new materials, processes, and equipment. Here, at the Fair, all these developments may be studied and compared with counterparts from other countries.

In the articles that follow, leading personalities of the German plastics industry present a comprehensive review of plastics in Germany today and preview the trade fair for our readers. Dr.-Ing. Karl Mienes, in his remarks beginning on p. 124, brings us up to date on German plastics developments. Dr. Bruno Gentzcke previews the machinery that will be on display at Düsseldorf, starting on p. 128. What the visitor can expect in the line of plastics materials is outlined by Dr. Wilhelm Mauss, beginning on p. 134. An advance look at the latest applications on view at the show is provided by Dr. R. P. Sondermann, starting on p. 136. The two programs, followed by a classified list of exhibits begin on p. 142.

"Plastics 1959" to be international in scope and interest

Plastics in Germany

By Dr.-Ing. Karl Mienes

In the past year, production by the German plastics industry has shown an increase of about 11.5% and reached 643,000 tons; this is about 16% of world production, which was around 4 million tons in 1958.

The greatest increase in volume was shown by polymerization products from copolymers, polyolefins, and acrylic resins, each of which had a share of 25 to 30 percent. The combined group of polyesters, epoxy resins, silicones, and polyaddition compounds increased by almost 45 percent.

By the end of this decade, statistics will probably be more strongly influenced by polypropylene, modified polyolefins, styrene graft polymers, PVC-polyblends, polyesters of carbonic acid, and highly viscous melting polyamides.

The products which are now in advanced stages of development are the ones which will swell future production figures. An important contribution will be made by new and modified production methods which can more easily handle the characteristics of the modified or newly developed plastic materials.

An example of such developments are inner liners for refrigerators of high impact polystyrene or housings for domestic appliances of highly viscous melting polyamide which can be produced more successfully on screw-type injection molding machines than is possible by conventional methods. The development of the return flow "valve" has overcome the obstacles which hitherto prevented the universal use of these machines. This valve is a device which may be compared with a travelling torpedo that exerts a piston-like pressure. Its combination with the screw plastication and flow valve is extremely useful for processing polymers having a high melting viscosity, for example, polycarbonate, because it prevents the loss of pressure and ensures strainless solidification. This makes it possible fully to develop the properties of such plastic materials as determined by their molecular and structural characteristics, their dimensional stability, and the lack of cold flow. Even attaching special screw plasticization aggregates to conventional machines increased production by 50% or more.

Linear polyethylene and polypropylene account for about one-third of the total production of polyolefins, which is a remarkably high percentage compared with other countries. A further increase in the production of both linear and branched polyethylene will take place during the coming years, and the ratio of consumption of linear and branched PE is likely to be about 25:75.

There is an increasing tendency to use mechanically or electronically controlled automation in modern processing plants. In the important field of sheet production, the sequence starts with filling the raw material into a central distributor for all participating extruders, and ends with the finished layflat tubing, the processes associated therewith or connected thereto—the corona discharge permitting the printing, the actual printing, the coating with dispersions to produce improved aroma density, or the perforating and heat-sealing. Modified methods and more intensive cooling permit more economical operations and the production of transparent sheets on the basis of polyethylene and propylene copolymers.

In the case of PVC, polyblends with better aging resistance have been developed with chlorinated polyolefins or

Dr.-Ing. Karl Mienes *was born February 3, 1905, in Aachen. From 1923 to 1927, he studied medicine and chemistry at the Universities of Muenster, Aachen, and Berlin, where he took his doctor's degree in 1933. From 1930 to 1947, he held leading positions in the German plastics industry and also carried out scientific studies at the Kaiser Wilhelm-Institute, Berlin-Dahlem. Since 1948, he has worked as a consultant and expert in the manufacture and processing of plastics. He is an officer of several German plastics organizations, and a member of the board of a number of companies in the plastics industry.*

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Ultrapas	Melamine grades of all types
Mipolam	Polyvinyl chloride grades Granulated and biscuit gramophone record material of vinyl copolymers.
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Trolitul	**Thermoplastic Moulding Materials:** Polystyrene according to Standard DIN 7741, high-impact grades of polystyrene
Mipolam	Polyvinyl Chloride with plasticizer
Mipolam	**Extrusion materials:** Granulated Polyvinyl Chloride with plasticizer for insulation of cables and conduits
Astralon	**Polyvinyl Chloride or polyvinyl chloride copolymer;** sheets, laminated materials, rods and tubes, especially for scales, drawing and measuring devices, slide rules, advertising and illumination articles, vacuum forming grades for deep drawing purposes, e. g. refrigerator door panels and inner linings, licence plates for motorcars, etc.
Astralon	**Dimensionally stable cartographic sheet** mounting and reproduction work printing material of various types for stereos etc.
Trolitul ST	**High-impact polystyrene for deep drawing purposes,** e. g. display articles, and for application in the refrigerator industry.
Trovidur	**Unplasticized polyvinyl chloride** in the form of foils, sheets, blocks, tubes (also with fittings), rods, hollow rods, profiles, welding rods, for application in the chemical und allied industries
Trolen H	**Low-pressure polyethylene** (hard polyethylene) in the form of sheets, foils, blocks, tubes, welding rods
Mipolam	**Plasticized polyvinyl chloride:** Smooth, embossed and printed foils for fancy goods, for rainproof and protective clothing, foils for book binding purposes, embossed foils for leather goods, office equipment, upholstery, high lustre polished sheet
Mipolette	Smooth, embossed, and printed foils for decoration
Mipofix	Smooth, embossed, or printed adhesive foil
Librafol	Book binding material of flexible polyvinyl chloride foil, paper backed
Libradur	Rigid polyvinyl chloride sheets as stiffening material for briefcases and book binding purposes
Mipolam	Plasticized polyvinyl chloride foils and sheets for technical applications: sealings, linings, protective panelling profiles for technical purposes, amongst others for application in automotive engineering, acid.-resisting hoses
Trolen	**High-pressure polyethylene** with and without addition of polyisobutylene: foils, sheets, tubes, and welding rods
Trovitherm	**Polyvinyl Chloride** packaging foils types G and UG.
Ultrapas	**Resin-bonded laminated sheets** for decoration and interior furnishing in various shades and patterns, dimensions: 2440 x 1220 (8 ft x 4 ft) and 2800 x 1220 mm (9 ft x 4 ft).
Mipolam	**For covering of floors,** tables, and doors, 2 and 3 mm thick
Mipolam	**Stair-nosing and skirting profiles,** handrails for banisters etc., tube covering, profiles for shop-windows and casement windows
Tronex	Endless corrugated polyester sheeting for roofing purposes balcony linings, partition walls etc.

polyolefin copolymers (Farbwerke Höchst A.G.), which supplement the non-rigid variants with elastified types. Incidentally, the very factors which impede extrusion of the polystyrene blend, for example, rubber-like admixtures have a facilitating effect in this case and improve behavior under cold conditions.

Blow molded containers

The highly developed technique of blow molding containers with a calibrated pin from the bottom, preferably by using simple tools, promotes the processing of shock-resistant PVC-types. Thin-walled containers with from 2 to 20 gal. capacity have, for some time now, been successfully blown from branched polyethylene. These containers, combined with fiber-drums, have resulted in considerable freight and insurance savings.

The molding of modified PVC structures, with large dimensions, such as inner containers of refrigerators, by a combined deep drawing process has been done successfully in Germany for some time past. However, it is difficult to predict which material, high-impact polystyrene or modified PVC, and which process, the highly developed deep drawing technique or the modern injection molding, will make a greater impact on the art.

The requirements of operating more economically, of improving the quality and of lowering the price of the final product are closely linked to further increases in production. Ever increasing competition during the coming years will inevitably produce these results forcibly. The production of technically high-quality articles generally precludes the use of automation. Instead, there will be a tendency increasingly to automate separate processes. The operational process will be dominated by automatic registering, counting, and adding. The heterogeneous production process will be associated with a movable combination of instruments which will indicate operation or standstill, will register reasons for interruptions and will supervise the production.

There also is a very pronounced tendency to use time-saving devices and to arrange simultaneous processing instead of successive operations. Examples of this tendency are automatic revolving extruding machines and transfer presses controlled in series having a central extruder feed for thick-walled PVC fittings.

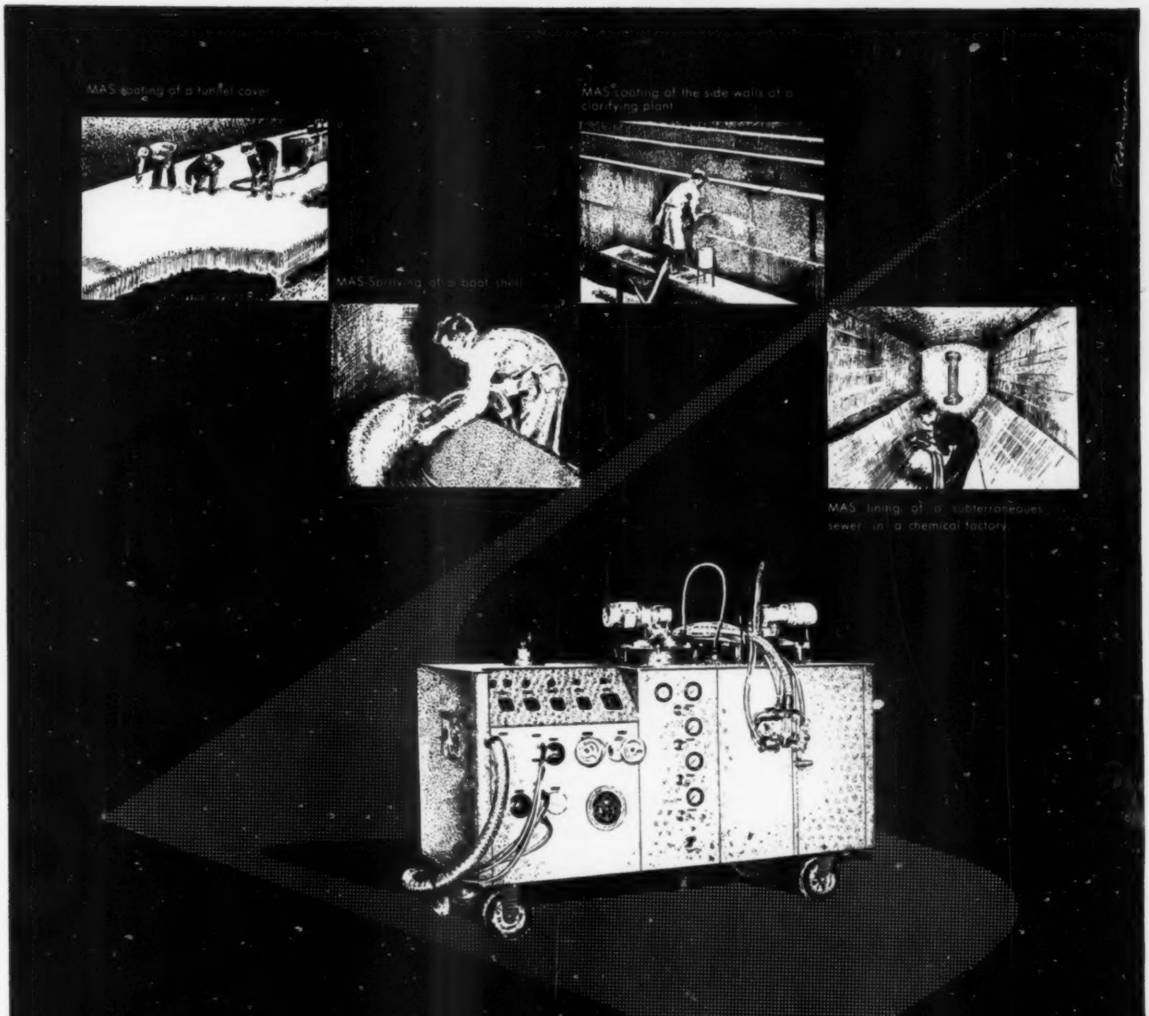
The latest development aims at performing the plasticizing and forming steps in separate but overlapping operations. The Engel machine (licensed to Foster Grant for the United States and Canada) works on this very economical principle. It is still too early to evaluate the full significance of this development for the extrusion and injection molding processes.

Increased demand in the past years has demonstrated the lack of elastomeric properties in the range of high-polymer materials. The growth of elastomeric materials has undoubtedly been slowed down by a lack of highly developed processing techniques. Ever since it has been recognized that the processor must follow certain basic rules which govern manufacture, elastomeric products such as cross-linked poly-addition compounds have gained in importance. A typical example is the procedure used for urethane foam with the highly developed one-shot system. By means of continuously formed paper molds, which are automatically removed after solidification, an hourly output of 120 cubic meters is obtained, and these devices also permit the processing of prepolymers of polyethers.

Foaming-in-place methods

Considerable progress has also been made by the foaming-in-place methods. Portable foaming devices operate in accordance with the counterflow injection principle. Typical applications are doors for vehicles, with an outer skin of 0.8 mm. of aluminum sheet into which the reaction mixture is foamed. This has resulted in a 15 to 20% saving in raw materials and general overhead. Tests made with bus doors showed that all accessories and fittings were worn out after the doors had been opened and closed 1.5 million times, whereas the compound made of metallic skin and foam remained completely intact.

It is known of course that expandable polystyrene foams are produced in Germany in the presence of low-boiling hydrocarbons in the polymerization process. In the meantime, the technique of using the expandable granulate in continuously operating mixing heads has ad-



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vanced to a point where it compares with the production of blocks having a content of 1 cubic meter of a surface of three square meters. Such blocks move by their own weight and are guided at an angle through parallel incandescent filaments to produce slabs, sheets, and profiles.

To return again briefly to the field of polyester urethane and elastomeric plastics materials, it becomes evident that modification of the material and perfection of processing techniques results in bigger volume. In the case of urethane elastomers where a slightly cross-linked prepolymer is used, the casting and centrifugal technique for shaped articles such as gears or sheets is of primary importance. In cases in which casting or pouring cannot be used, for example, for profiles and tubes, the process starts from high molecular weight isocyanates, which are processed and cross-linked with polyesters like the conventional rubbers.

The developments in Germany in this field are probably similar to those in the U. S. A. This is also true with respect to wire coating with urethanes and the efforts to improve permanent heat resistance by using terephthalate polyesters in conjunction with blocked isocyanates.

It would go too far to extend this discussion to some of the other plastics materials. The development of polyamides in Germany and the extensive specialization in this sector has created new impulses. The manufacture of special high molecular weight types for creep resistant and permanently pressure resistant products in rail insulation is only one example of many. Conventional silicone rubber has now been joined by castable solvent-free compounds. Epoxy resins of the bisphenol type are being used increasingly for metal bonding systems in airplanes and structural bridge elements. U. S. impulses relating to this group and to the polyfluoroolefins have found a vivid response in Europe.

Previewing machinery at the Fair

By Dr. Bruno Gentzcke

In order to understand why the Exhibition Kunststoffe 1959 is of such special interest for the buyers of machinery, one should not only compare it with the 1955 Show, but should go back 10 years. Only then can one really evaluate the tremendous developments that have taken place, not only in the production of a constantly growing number of new plastics materials, but also in the new processing and fabricating techniques.

Ten years ago the United States was leading, then followed by Great Britain and a long way behind by Western Germany. Hardly any machines were made in the remaining countries and in those mentioned only a relatively small number of companies were engaged in building machines and the variety of machines was very limited. Today, machines for processing plastics materials are built in almost all countries of Europe. I want to mention Switzerland, France, Italy, Austria, Belgium, The Netherlands and also Spain.

Compared with 1950, the monetary volume of machine production in Western Germany has increased eightfold, and if one takes into account increases in prices during this period, it has risen to about six times its value. A similar situation is true in the United States and in Great Britain and I believe that their importance in the commercial developments of the future has only just begun. The development of plastics materials and therefore of machines for their processing, is still in its early stage. The chemistry of plastics materials with its inexhaustible range of discovery will undoubtedly bring about

Dipl.-Ing. B. Gentzcke, *62, is the manager of the "Fachgemeinschaft Maschinen für die Verarbeitung von Gummi und plastischen Massen" in the Verein Deutscher Maschinenbau-Anstalten e.V. (VDMA). After ending his study at the Technical High School in Berlin-Charlottenburg, he has been working for several leading firms of the German industry. Since 1940, he has worked for the VDMA, and in 1949, the "Fachgemeinschaft Maschinen für die Verarbeitung von Gummi und plastischen Massen" was founded and he took over this management.*

techniques which are not yet thought of and will lead to the development of special, as well as volume applications in areas which we can hardly dream of at this stage. Since machines and production techniques are closely linked, all industrialized countries will participate in these developments.

Table I gives a picture of the developments in Western Germany in the last two years, divided by types of machines.

Since there were no price increases in 1958, this represents a real increase of almost 25 percent. Furthermore, incoming orders are running an additional 8 to 12% above the increased 1958 production figure. Particularly noteworthy is the increase in the number of injection molding machines (almost 50%), due in part perhaps to the increasing use of screw-type machines which have recently made an impact.

These figures alone would not give a clear picture, if one did not take into account the imports shown in Table II, p. 132.

That table shows that the plastics processing industry of Western Germany, after deducting machinery exports, obtained 13% of its requirements from abroad, but not only from countries that traditionally supply machinery, such as the United States and Great Britain, but also from the other countries, which indicate that these machines, too, are good.

Table III, which shows the figures of world exports of machinery in our industry, is equally informative.

I have included these three tables because they illustrate the international ramifications, in this case of machine building. It is well known that the countries with a highly developed industrial structure are afraid of competition, but in fact engage in a lively exchange of goods.

About 140 companies engaged in building machinery from all the above mentioned countries have registered for Kunststoffe 1959; in addition, there are the manufacturers of tools and molds, the suppliers of accessories, such as testing and other instruments, so that altogether about 180 companies will exhibit their products in a gross area of 16,000 square meters, which is more than twice as much as in 1955. Naturally, Germany has the main contingent, but almost 50 companies from abroad are represented in order to show their most recent products.

The visitor to the Fair will find advances in automation of particular interest, and in addition, the achievements and constant improvements of manufacturing

Table I:

West German production of machines for processing plastics and rubber in 1957 and 1958 (In millions of U. S. $)

Since there were no price increases in 1958, this represents a real increase of almost 25 percent. Furthermore, incoming orders are running an additional 8 to 12% above the increased 1958 production figure. Particularly noteworthy is the increase in the number of injection molding machines (almost 50%), due in part perhaps to the increasing use of screw type machines which have recently made an impact.

Type of Machine	*1957*	*1958*
Rolling mills and calenders	5.4	7.2
Grinders, mixers, kneaders and blenders		
Extruders	7.1	8.2
Mechanical and hydraulic presses (without heater bands)	3.9	5.1
Dipping, spreading machines, and gelating apparatus	0.8	1.0
Machines for manufacture, repair and retreading of tires	1.8	2.9
Rubber and vulcanizing molds	1.9	2.3
Vulcanizing installations (including heater bands)	1.8	2.7
Injection molding machines (not including molds)	7.5	11.2
Forming machines	0.2	0.3
Other processing machines	5.7	4.2
Accessories, spare and replacement parts (not including molds)	3.8	4.8
TOTAL	43.0	53.4
Total Export	20.5	23.9
Export %	47.6	45.0

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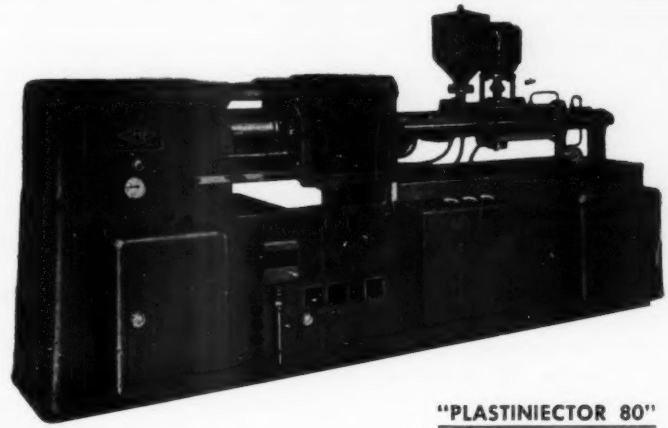

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Table II: Sources of West German imports of machinery for plastics and rubber processing in 1957 and 1958 (in millions of U. S. $)

Total imports		*European Common Market*[a]	*Great Britain*	*Switzerland*	*U. S.*	*Other countries*
1957	3.7	1.4	0.9	0.7	0.6	0.1
1958	5.4	1.4	1.2	1.5	1.1	0.2

[a]Belgium, France, Italy, Luxemburg, The Netherlands.

processes. Designs have been developed with the close cooperation of the electrical industry and permit rather comprehensive automatic processing of plastics materials. In addition, there will be exhibits which demonstrate with which machines and in what manner the newly-developed plastics materials can best be processed.

Furthermore, Düsseldorf and also Hannover now offer the possibility to show not only large but *the* largest machines such as calenders and other machines which weigh 100 tons and more. Consequently, everything will be shown from the heaviest calenders to mixers of every type, machines for reinforced plastics, extruders, injection molding machines up to the largest types, vacuum forming machines, machines for the production of hollow objects, presses, high frequency heat sealing equipment, metallizing apparatus, printing machines, to mention just the most important categories; in addition, accessories of all types, molds, measuring instruments, testing equipment, and other machines for post-treatment.

The technological progress plays a particularly important part in the investment policy of the plastics processing companies. The results of research constantly lead to the production of new plastics materials and to improvements in processing and applications. The machinery inventory becomes more rapidly obsolescent than in many other industries. Consequently, of the total amounts invested by the plastics processing industry, about half is invested in machinery.

Conclusion

In conclusion: The machinery halls of the coming Düsseldorf Exhibition will give an almost complete picture of the current status of processing techniques and will be a unique source of information. Naturally, the machines exhibited there are of primary importance, but because the visitor can meet with many experts within a matter of hours or days, and can talk about subjects of mutual interest, an exchange of ideas is possible, whose practical value can probably not be equalled in any other way.

And just as the further developments of plastics materials does not give any indication of reaching an end, parallel developments in the field of processing machinery indicate further improvements and refinements. In this sector, too, many things are still in a state of development, but the advances compared with 1955 in all sectors are gigantic. (To page 134)

Table III:

World export of machinery for processing of plastics and rubber materials from 1954 through 1958 (In millions of U. S. $)

Country of origin	*1954*	*1955*	*1956*	*1957*	*1958*
U. S.	21.3	27.1	31.0	37.2	30.8
West Germany	7.9	11.2	15.7	20.5	23.9
Great Britain	7.3	6.8	6.8	13.7	15.8
France	1.4	2.0	0.8	1.5	2.6
Belgium/Luxemburg	0.3	0.3	0.2	0.3	0.4
Netherlands	0.2	0.1	0.3	0.2	0.2
TOTAL	38.4	47.5	54.8	73.4	73.7

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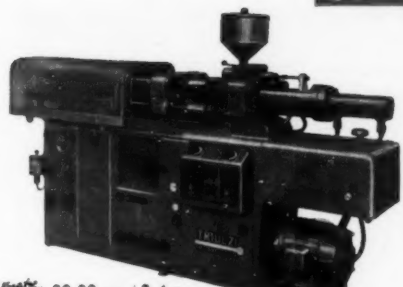

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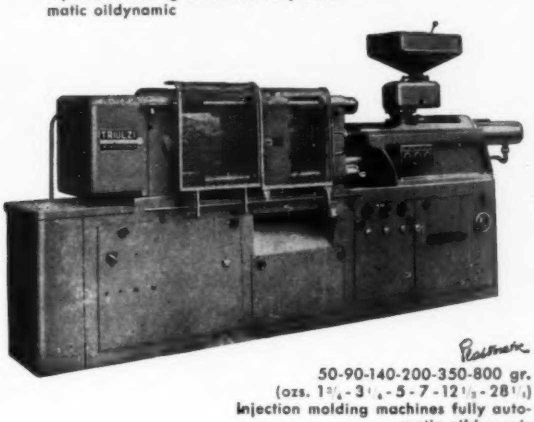

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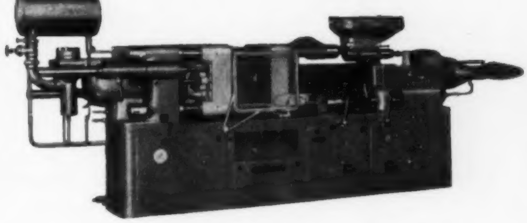

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Materials on exhibit at the show

By Dr. Wilhelm Mauss

The Plastics Exhibition at Düsseldorf from October 17-25, 1959 is the fourth Plastic Exhibition in Germany after the war. It is different from its predecessors in so far as it is arranged on an international basis, so that the visitors can compare the products of practically every country of the world with the products of competitors; a possibility to compare which is the more interesting now after the Common European Market begins to become a reality.

At Düsseldorf the visitor will meet the products of about 500 firms, 370 of which are out of Germany and about 130 firms out of 13 other countries, with the exception of Japan and of the countries behind the Iron Curtain. These 500 firms represent nearly the whole world.

For the experts the Düsseldorf fair will be especially attractive as in the first days there are a IUPAC symposium concerning the aging of plastics and the "Eighth German Plastics Conference" offering lectures concerning problems of converting plastics. In this connection it is worth mention that just before the Düsseldorf fair an International IUPAC Symposium on Macromolecules will be held at Wiesbaden from October 12 to 16, 1959. At Wiesbaden world-known scientists will read papers on macromolecules which will be of interest to all experts in the field of plastics. Thus one has the possibility to combine scientific interests with a big show of the present status of the plastic industries of the whole world. As to the Düsseldorf fair, the visitors can be sure to see the newest developments in all fields. In the following lines I will try to give a short preview of the materials to be found at the fair.

Besides the old, but still rather important viscose films, the modern combined materials such as viscose film coated with polyethylene or polyester films (Mylar, Hostaphan, Mellinex) coated with polyethylene will prove that the packaging industry still can hope to get better and better materials. The last mentioned polyester combinations are rather resistant against higher temperatures and have great mechanical strength.

Another interesting product is cellulose acetate butyrate which by a special coating process yields coatings of high strength, excellent electrical properties, and resistance against oils.

It will be interesting to see that phenolic plastics modified by melamine show new properties, as f.i. stability under different climates, which make them useful for new applications. Also, flexible Dekorplates with a melamine coating should find great interest in the furniture industry. Another new product is a phenol resin which is electro-conductive and can be used for the production of metallized parts with the galvano-process.

In the field of polyamides for injection molding, new types will be shown which have improved dimensional-stability and which can be taken out of the molds at higher temperatures, thus speeding up production.

There will be shown polycarbonate products with high resistance against heat

Dr. Wilhelm Mauss *was born September 9, 1903 in Luebeck. After finishing a high school, the "Johanneum," at Luebeck, he went to the University of Marburg to study chemistry. At Marburg he obtained the grade of Phil. Dr. in 1927 with a dissertation in the field of organic chemistry. He spent some time as assistant at the Marburg University. At the end of 1928 he joined the patent department of I. G. Farbenindustrie at Frankfurt/Main-Hoechst and changed to the patent department of Kalle & Co. A.G., Wiesbaden-Biebrich in 1930, becoming head of that department in 1935. Later Dr. Mauss was appointed technical director of Kalle & Co. A.G. After the war he was for some years the sole trustee of that firm, and after 1952 he was appointed a member of the board of directors. He is chairman of the VKE (Association of German Plastic-Producers) and of the AKI (Common Organization of German Converters and Producers of Plastics), two organizations responsible for the big Plastic Fair at Düsseldorf. He is a member of "Gesellschaft Deutscher Chemiker" of the Max Planck Society and of the "Verwaltungsrat" of the "Deutsches Museum" at Munich.*

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and cold, and with a good dimensional stability, which are relatively easy to convert.

Further, there will to be seen glass fiber mats impregnated with polyester resins which can be formed by molding into articles that are not obtainable by other means.

New developments will be shown in polyethylene of the high pressure quality as well as of the low pressure qualities. The latter yields a film rather suitable for deep drawing processes. It is hoped that polypropylene films will be shown also.

New types of polyurethanes, polyesters, silicones and epoxy resins will be shown; these new types will find application in interesting fields. Furthermore, they will be rather suitable as raw material for lacquers, glues, and binders.

In this short article of introduction, it is not possible to mention more details about the content of the Düsseldorf fair. But any visitor can be sure to get a compact picture of the plastic industry of the world, an opportunity not given elsewhere, and to find just those things he is looking for. Furthermore, the visitor will meet a great number of experts in the plastic field so that a visit of the fair will certainly prove to be rather useful.

Latest applications at Düsseldorf

By Dr. R. P. Sondermann

It is more than a fortunate coincidence that on the occasion of the International Plastics Fair 1959 in October at Düsseldorf we are celebrating the 100th anniversary in the epoch of plastics.

Within the relatively short period of 100 years, plastics have conquered such a great number of fields of application in trade and industry as no other material has ever done before. In Germany their application, especially since 1948, has led to a never expected stormy development. Thereby we not only found again the necessary contact with world-production, but today we have again taken an important place in the world market.

The past year brought about a considerable expansion of production and increase in turnover. Thus, for instance, the turnover of the Plastics Processing Industry rose approximately 23% from 1957 to 1958.

Consistent improvements in production brought a stabilization of the price index compared to the previous year.

On the basis of this positive development, it is a pleasure to be able to invite experts from foreign countries to Düsseldorf in order to have an exchange of experiences and ideas, and to compare our achievements with those of other countries on the occasion of the first International Plastics Fair.

The remarkable progress in the development of new plastics and in the opening up of new possibilities of application is radiating into all aspects of our daily life. Industry and consumer, engineering and agriculture, construction industry, communications and medicine—only to mention a few—are constantly receiving new stimulations. For this reason a preview to "K 59" cannot be confined to show just limited programs, but it is certain that the coming International Show will offer to the expert some unexpected surprises.

A large part in the application of plastics is taken up by the **electrical industry.** New PVC-types with hitherto never reached insulating values and good temperature resistance will be displayed next to stereo-specific polypropylene in connection with electro-articles of various kinds. The visitor will be able to see the

Rolf Peter Sondermann, *45 years of age, started to work for Rheinische Gummi-und Celluloid-Fabrik, Mannheim-Neckarau, early in 1946 and later took over as sales manager of the Celluloid Department. Subsequently he became sales director for all products of this company, and has been on the Board of Directors since 1958. Since November 1958 he has also been the Chairman of the Gesamtverband Kunststoffverarbeitende Industrie (Association of Plastics Processing Industry)*

young group of polycarbonates on a broad basis in their practical application. The various possibilities of solutions for printed electrical diagrams on copper-covered, molded laminates may be studied on the objects themselves not only on phenol-laminated papers and fabrics, but also on a number of newly developed glass-laminated fabrics with epoxy resins, silicon resins and Fluorocarbon plastics.

Of special interest in **machine construction** is the continuous new development of bearing materials without lubrication on the basis of polyamides and fluorocarbons. In this field we hope to be able to show a number of things primarily to the textile- and food-machine industry.

Automotive uses

The automobile industry, today, is not alone concerned with the replacement of materials hitherto applied, but new plastics have been developed which are showing new ways with their specific properties. Muffling of noises, corrosion resistance, light weight, inexpensive production and assembly conditions, recommend increasingly the application of plastics. Up to the present time the German automobile industry has somewhat hesitantly approached the use of glass fiber-reinforced plastics in the field of automotive body construction for economic reasons. However, these plastics are already being used in this country in the construction of small automobiles and driver's cabs of trucks. Padding of steering wheels and dashboards with plastics are serving accident insurance today.

Plastics serve in the **building industry** primarily as linings of surfaces and for decoration. Conservative opinions, so far, have made the more widespread application of plastics in structural applications impossible. However, it is to be hoped that samples exhibited at the Fair will offer stimulations for additional groups of consumers.

As construction aids, building elements made of plastics play an important part. All kinds of plastic sheets are being used for the protection against soil moisture, subsoil, rain, heat and cold in increasing numbers. In order to restrain the influence of heat and cold as well as the muffling of sound, new types of plastic sheeting, sheets and shells made of polystyrene have been announced.

In general, a tendency to use more sandwich panels made of plastics with various surface layers can be observed, whereby apparently suggestions received at the Brussel's Worlds Fair are being followed. Let us not forget the numerous possibilities of application for glass fiber-reinforced polyester light panels and sheets. These plastics have recently found a number of gardening applications.

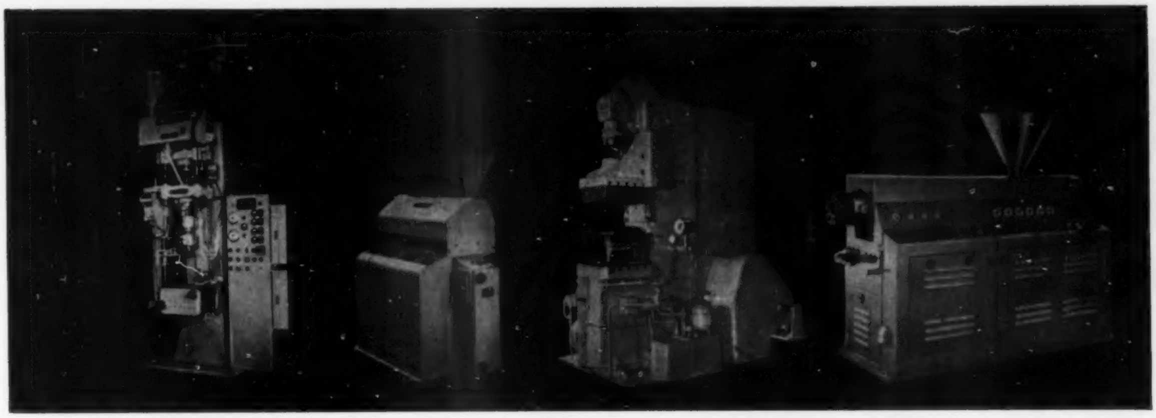
Endless pipes made of polyethylene or PVC with special, easily attachable fittings to be used in water installation are also being shown. The same material is finding increased uses in pipes.

In the **mining industry** semi-finished products and equipment, tools, installations and safety-devices made of plastics are being used in steadily increasing numbers. In the field of conveyor construction, plastic elements are in demand more and more because of their corrosion resistance and light weight. Litters and also sliding litters made of glass fiber-reinforced polyester, with non-flammable PVC-laminated protective suits made of synthetic fiber fabrics, helmets to be used in mines, non-swelling and non-rotting firehoses made of polyester fiber, are some of the many items serving safety.

In the field of **household appliances** we are at the beginning of a new development stage. The polypropylene which can be heat sterilized will be another point of attraction to the visitor of the fair.

Medical applications

Hospitals and medicines are showing today a greater interest than ever in plastics. Beginning with wall and floor covering to the equipment of doctors and nurses, plastics of all kinds offer additional fields of application because they can be easily cleaned and sterilized. Polyamides, not harmful to the tissue, are used for the manufacture of artificial arteries, for implantations and suture material as well as for surgical brushes and nets. Interesting developments have been observed in the use of polycarbonates, which keep their shape up to temperatures of 135° C. (275° F.). Germ-free wound dressings made of foamy plastic based on urea resin can be sterilized and (**To page 142**)



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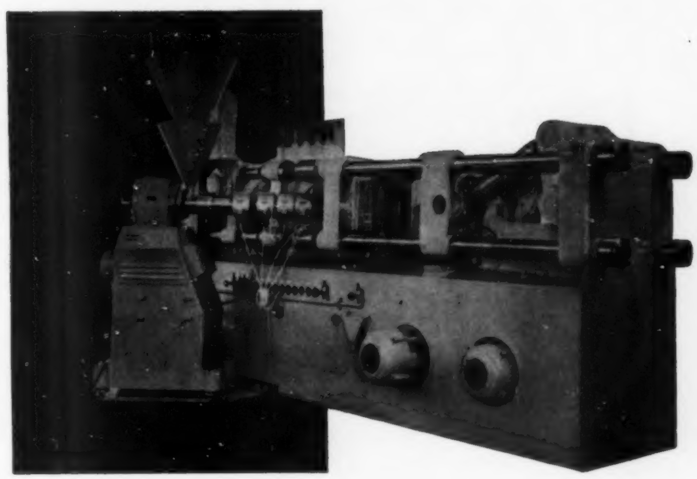

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are being used as lamination material and powder, are some of the items to be displayed at the exhibit.

Finally, we should like to point to the use of modern compound-materials which are gaining increasing importance in the field of space exploration. These materials may even become indispensable in this particular field of exploration.

All these facts seem to prove that the International Plastics Fair "K 59" will offer to the foreign visitor a number of interesting new items. One thing is certain, however, that its most important purpose will be to bring about the mutual exchange of ideas and experiences of the experts and to offer new and valuable stimulations for the future development, working processes and applications.

The Plastics Processing Industry is happy to be able to foster and to further this exchange of ideas.

IUPAC* Symposium Program

Aging of Plastics

"General Introduction: Terminology, theories, practical considerations," by Dr. H. Stäger, Zurich, Switzerland.

"Chemical structure and stability relationships in polymers," by Dr. G. M. Kline, and B. G. Achhammer, Bureau of Standards, Washington, D. C.

"Permanent physical changes in high polymers and their determination," by Prof. Dr. F. H. Müller, Marburg, Germany.

"Durability of plastic pipe," by Dr. K. Richard, Frankfurt, Germany.

"Stress cracking of plastics," by Dr. I. Hopkins, Bell Tel. Labs, Murray Hill, N. J.

"Natural and artificial aging of high polymers in fiber form," by Dr. A. Sippel, Freiburg, Germany.

"Weathering resistance of plastics," by Prof. Dr. P. Dubois, Paris, France.

Program for the 8th German Plastics Convention

Tuesday, October 20

Opening: Dr. Wilhelm Mauss.
Chairman: Dipl.-Ing. Erich Mollberg.

The manufacture of plastic parts

9:00-10:00 a.m.—**"From the design to the finished part."** A discussion of the molding construction and finishing of plastic parts. Obering. Hans Beck, Dipl.-Ing. Theodor Henne, Ing. Hans Volland, Dr.-Ing. Wilbrand Woebcken, and other speakers to be selected.

10:00-10:30 a.m.—**"Steel molds for plastics processing,"** by Vincenz von Reimer.

10:30-11:00 a.m.—**"Electroplated nickel molds for plastics,"** by Peter Spiro, B.Sc.

11:00-11:20 a.m.—Discussion.

11:20-11:40 a.m.—Intermission.

11:40-12:30 p.m.—**"Legal aspects, taxes, and claims with regard to contracts,"** by Dr. jur. Heinrich Issel.

12:30-1:00 p.m.—Discussion.

Tuesday afternoon

First showing of an educational motion picture dealing with plastics, made by "Arbeitsgemeinschaft Deutsche Kunststoff-Industrie" and the Institute of Films and Pictures.

1. Plastics, their structure and their properties.

2. Plastics and plastics processing.

Introductory remarks: Prof. Dr. F. H. Müller and Erwin Pätsch.

Wednesday, October 21

Chairman: Dr.-Ing. Josef Grassl.

9:00-9:50 a.m.—**"Lightweight, heavy-duty parts made of fibrous glass-reinforced**

*International Union of Pure and Applied Chemistry. This program will be given Oct. 19 in Dusseldorf.

plastics," by Dr.-Ing. Ulrich Hütter. The speaker will illustrate this talk with a motion picture.

9:50-10:20 a.m.—**"Limit of thermoelastic deformation of thermoplastics,"** by Dr.-Ing. Heinz Peukert.

10:20-10:30 a.m.—Discussion.

10:30-10:45 a.m.—Intermission.

10:45-11:30 a.m.—**"Plastics for the packaging of foods,"** by Prof. Dr.-Ing. habil Rudolf Heiss.

11:30-12:15 p.m.—**"Plastics in house construction,"** by Dr. phil. nat. George Schulz.

12:30-1:00 p.m.—**"Organization and activities of the Bureau of Documentation of the German Plastics Institute,"** by Prof. Dr. phil. Karl-Heinze Hellwege.

Classified list of exhibitors

Raw materials and semi-finished goods

Algemene Kunstzijde Unie N.V., Arnhem, Holland.

Badische Anilin- u. Soda-Fabrik AG., BASF, Ludwigshafen.*

Bakelite Ges. mbH., Letmathe.

Bakelite Ltd., London S.W.1, England.

Beck & Co., Dr., GmbH., Hamburg.

Bisterfeld & Stolting, Egerpohl.

British Industrial Plastics Ltd., London W. 1, England.

Bunawerke Huls GmbH., Marl, Krs. Recklinghausen.

Carnavar-Corporation, Bern, Switzerland, and Frankfurt.

Celluloidfabrik Speyer, Fr. Kirrmeier GmbH., Speyer.

Chemische Fabrik Dr. Herbert Wolff & Co., Hamburg-Eidelst.

Chemische Werke Albert, Wiesbaden-Biebrich.

Chemische Werke Witten GmbH., Witten.

Deutsche Advance Produktion GmbH., Marienberg b. Bensheim.

Dynamit-Actien-Ges., vorm. A. Nobel & Co., Troisdorf/Bez. Koln.

Farbenfabriken Bayer AG., Leverkusen-Bayerwerk.

Farbwerke Hochst AG., Frankfurt (M)-Hochst.

Gewerkschaft Philippine, Oberlahnstein.

Goldschmidt, Th., AG., Essen.

Hagedorn & Co., A., AG., Osnabruck.

Henkel & Cie., GmbH., Klebstoffwerk, Dusseldorf-Holthausen.

Herberts & Co., Dr. Kurt, Wuppertal-Barmen.

Herbig-Haarhaus AG., Koln-Bickendorf.

Holzverzuckerungs AG., Zurich, Switzerland.

Imperial Chemical Industries Ltd., London, England.

Internationale Galalithgesellschaft AG., Hamburg-Harburg.

Jager, Ernst, Fabrik Chem. Rohstoffe GmbH., Dusseldorf-Reisholz.

Kalle & Co. AG., Wiesbaden-Biebrich.

Kautschuk - Gesellschaft mbH., Frankfurt.

Koepp & Co., Rudolf, Chemische Fabrik AG., Oestrich. (Rheingau).

Mikro-Technik GmbH., Miltenberg-Burgstadt.

Monsanto Boussois, Paris, France.

Montecatini, Milan, Italy.

Omya GmbH., Koln

Oxydo Ges. fur chem. Produkte mbH., Emmerich.

Polypenco, Inc., Reading, Pa.

Raschig, Dr. F., GmbH., Ludwigshafen.

Reichhold Chemie AG., Hamburg

Resart-Gesellschaft Kalkhof & Rose, Mainz.

Rheinpreussen AG fur Bergbau u. Chemie, Homberg (Ndrrh.)

Schaum-Chemie Wilh. Bauer KG., Essen.

Shell Petroleum Co. Ltd., London, England.

SIC Mazzucchelli Celluloide, Varese, Italy.

Sicedison S.p.A., Milan, Italy.

Solvay, Germany, Benelux, France, Italy, Austria, Spain, Brazil.

Sudd. Kalkstickstoffwerke AG., Trostberg (Obb.)

Sudwestdtsch. Kunstharz-Werk Dr. Elbel GmbH., Frankfurt.

Titangesellschaft mbH., Leverkusen.

Union Carbide Internat. Comp., New York, N. Y.

Wacker-Chemie GmbH., Munchen.

Finished goods

ABC Kunststoffverarbeitung Tautenhahn GmbH., Senden/Iller.

Acker, Carl, Sohn, Schwelm, Westphalia.

Acla-Werke AG., Koln-Mulheim (Rheinland)

Adretta Plasticwerk, Weber & Bandow, Hamburg-Bahrenfeld.

Ahlmann & Co., Andernach (Rh.)

*Except where otherwise noted, all addresses are in Germany.

Aktienges. f. Zink-Industrie, vorm. Wilh. Grillo, Duisburg-Hamborn.

Alkor GmbH., Karl Lissmann KG., Munchen-Solln.

Allopal - Werk, Ingeborg Krages, Scheuerfeld (Sieg).

Anger & Co., GmbH. Gebr., Munchen.

Atlan Werk, Ludwig Sattler KG., Muhlacker (Wurtt.)

Bass & Keller, Langenargen.

Bauer, Julius, GmbH., Heilbronn.

Bauknecht, G., GmbH., Stuttgart-S.

B.A.T. Blachine & Apprets de Tarare, Tarare, France.

Bebrit Presswerk GmbH., Bebra/H.

Bellmann & Co., Ansbach (Mfr.)

Benecke, J. H., Hann. Wachstuch-u. Kunstleder-Werke KG. a. A., Hannover-Vinnhorst.

Berges, Friedrich, Marienheide.

Bergho J. Bergmann, Dortmund.

Betriebsgesellschaft der Fr. Moller'schen-Werke GmbH., Brackwede (Westf.) **(To page 146)**


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Bisterfeld & Stolting, Egerpohl.

Board of Trade, London, England.

Bock, Otto, Kunststoff KG., Duderstadt.

Bodenmuller, Gustav, Gubo, Nehren-Tubingen.

Bolta-Werk GmbH., Nurnberg.

Borrmann, Feodor, GmbH., Heidelberg.

Bosch, Robert, GmbH., Stuttgart-W.

Brainos & Co., London, England.

The Bristol Aircraft Ltd., Bristol, England.

British Geon Ltd., London, England.

Bues, Werner, Berlin.

Carrier Stephens, Paris, France

Chemieprodukte GmbH., Leverkusen-Rheindorf.

Chimique de Gerland S. A., Paris Ville, France.

Cogebi S. A., Lot-Lez-Bruxelles, Belgium.

Colasit AG., Wimmis B E, Switzerland.

Commercial Plastics Ltd., London, England.

Compagnie Continentale du Pegamoid S.A., Brussels, Belgium.

Continental Gummi - Werke AG., Hannover.

Corrokunststoff Corrosions-technik GmbH., Giessen.

Craemer, Paul KG., Herzebrock.

Dansk Termoplastisk Industri GmbH., Flensburg.

Degussa, Frankfurt.

Deisting & Co., Dr., GmbH., Kierspe (Westf.)

Deutsche Fibrit Gesellschaft Ebers & Dr. Muller GmbH., Krefeld.

Deutsche Frigolit GmbH., Worms.

Deutsche Plax GmbH., Gelsenkirchen-Rotthausen.

Deutsche Steinzeugwarenfabrik f. Kanalisation u. chem. Industrie, Mannheim-Friedrichsfeld.

Deutsche Tafelglas AG., Detag, Furth.

Dollken & Co., W., GmbH., Essen-Werden.

Dortmunder Plastik GmbH., Dortmund.

Draka Plastics Hollandsch. N. V., Draad- en Kabelfabriek, Amsterdam, Holland.

Drugmand & Meert S. A., Brussels, Belgium.

Dusseldorfer Plastic - Werk Otto Wolff GmbH., Ratingen.

Duster, Hans, oHG., Krefeld-Uerd.

Dupol GmbH., Offenbach.

Durapipe & Fittings, London, England.

Dynamit-Actien-Ges., vorm. A. Nobel & Co., Troisdorf, Bez., Koln.

Dynarohr-Werk GmbH., Mulheim.

Edil-Plastik S.p.A., Ferrara, Italy.

Ehage Rollofabrik, Erich Hinnenberg, Hochdahl d. Dusseldorf.

Ekco Plastics Ltd., Southend-on-Sea, Essex, England.

Elektrochemische Werke Munchen AG., Hollriegelskreuth b. Munch.

Engel, Wilhelm, Schalksmuhle/W.

Ernstmeier, Gustav, oHG., Herford.

Eschweiler - Bergwerksverein, Plastikwerk, Eschweiler-Aue.

Eternit, Soc. Ame., Belgium.

Etimex, Ges. f. Textil- u. Kunststoff-Erzeugnisse GmbH., Stuttgart-S.

Europlastic, Pahl & Pahl KG., Dusseldorf-Rath.

Farbwerke Schroeder & Stadelmann AG., Oberlahnstein/Rhld.

Farbwerke W. Urban GmbH., Oberlahnstein.

Fédération des Industries, Chimiques de l'Industrie de Belgique, Brussels, Belgium.

Fibrex, E. Traugott Olsen, Roskilde, Denmark.

Fibron, Wolfgang Mellert KG., Bretten.

Fickenscher & Sohne, A., oHG., Plastikwerk, Oberkotzau b. Hof.

F.I.P.L.A. Fabrica Industrial de Plasticos s.a.r.l., Praia d'Aguda, Portugal.

Fischer, Georg, A.G., Singen.

Folienfabrik Forchheim GmbH., Forchheim.

Formica GmbH., Bensberg-Refrath.

Forssmanholz AG., Wuppertal-Elberfeld.

Fyens Textil Compagni, Odense, Denmark.

Gebra-Plastik Gebr. Raderschad, Brol b. Hennef.

Gerdes, Glaus-Holmer, Luneburg.

Gerhardi & Cie., Ludenscheid/W.

Gesellschaft fur Werkstoff-Formung, E. J. Ritter KG., Mainleus.

Gewerkschaft Keramchemie, Siershahn.

Gill, Willy, Ludenscheid.

Glaswerk Schuller GmbH., Wertheim.

Gleitstoff-Gesellschaft Dipl.-Ing. Schuder & Co., Dusseldorf.

Goppinger Kaliko- und Kuntsleder-Werke GmbH., Eislingen.

Goppel, Franz, Dusseldorf.

Hafner & Krullmann, Leopoldshohe.

van Hagen, Wilh., Wwe., Iserlohn.

Hammersteiner Kuntsleder GmbH., Wuppertal-Vohwinkel.

Hassenzahl, H., Sohn, Pfungstadt.

Hecht, Heinz, Darmstadt.

Heinze, Richard, Herford.

Helge-Rollo-GmbH., Duren.

Heraeus, W. C., Hanau.

Herrmann, G. & L., Stuttgart-S.

Honicke, Walter, KG., Berlin.

Holzapfel & Co., Gebr., KG., Frieda.

Holztechnik GmbH., Mainleus b. Kulmbach.

Homann, Fritz, AG., Dissen.

Hornschuch, Konrad, AG., Weissbach.

v. Hunersdorff, R., Nachf. Fr. Buhrer sen., Ludwigsburg.

Huth & Sohne, Carl, Bietigheim.

Indewerk GmbH., Eschweiler.

Industrie Commerz GmbH., Frankfurt.

Industrie Riunite Sant'Antonio s.p.a. "Santoflex," Milan, Italy.

"Inku" Kunstoffvertrieb K. Smolka KG., Passau.

Jacoplast, Ennepetal-Voerde.

Jennes, H. Friedr., KG., Koln.

Jung & Simons, Haan.

Kalle & Co. AG., Wiesbaden-Biebrich.

Kappen-Orth, Franz Orth KG., Lubeck.

Kartell s.r.l., Milan, Italy.

Kautex-Werk Reinhold Hagen, Hangelar uber Siegburg.

Kellco GmbH., Keller & Pfahls, Hausen b. Offenbach.

Kleyer, Otto, KG., Minden.

Komet-Plastik GmbH., Soltau/Han.

Kommerling, Gebr., GmbH., Pirmasens.

Kreis, jun., Hans, Wuppertal-Barmen.

Kunnemeyer, Gebr., Horn.

Kuster, Ernst, Kolibri-Werk, Schotmar.

Kunststofftechnik Volgelsang, Huhn & Co., KG., Gevelsberg-Vogels.

Kunststoffverarbeitung GmbH., "Kusto," Hannover.

Kunststoffwerk Jacob, Ennepetal-Voerde.

Kunststoffwerk Lahr GmbH., Lahr-Dinglingen.

Laets, Leon-Fernand, S.A., Belgium.

Lahn-Kunststoff GmbH., Biedenkopf.

La Lactilithe. S.A., Tournal, Belgium.

"Les Plastiques de Roubaix," Roubaix/Nord, France.

Leubner, Rudolf, Ing., Kempten/Allg.

Lipp. Selluloidw.-Fabr. Knigge & Lindloff, Schotmar.

Lohmann KG., Fahr.

Lohmann & Welschehold, Meinerzhagen.

Lonza - Werke Electrochemische Fabrik GmbH., Weil. **(To page 150)**

Your Modern Plastics Encyclopedia Issue contains 1,218 pages of answers to questions like these:

"In *designing* plastic products, what factors govern the choice of surface decoration? Which features give added impact strength to thin edges? What can be done to correct warpage?"

"How do you set up a *cost estimate* for custom injection molding work? How do you set one up for compression and transfer molding?"

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"Why are epoxy resins especially recommended in *casting compositions* for use in encapsulation and potting of electrical and electronic components?"

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"What *printing method* is most commonly used in producing printed packaging films? And why is there a swing toward this process among decorators of light-gage polyethylene?"

"In reinforced plastics, what are the pros and cons of *matched-metal die molding?*"

"Where can you purchase electronic heat sealing machines?"

"Who are some custom molders and extruders around Cincinnati?"

What's <u>your</u> question?

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Mannesmann A. G., Dusseldorf.

Manufacture IPSA S. A., Uccle-Brussels, Belgium.

Maschek & Felds, Weissenburg.

Mauser-Werke GmbH., Koln-Ehrenfeld.

Meister, H. & G., AG., Zurich, Switzerland.

Mekufa, N.V., Vroomshoop, Holland.

Mellert, Josef, Bretten.

Metallwerk Elektra, Siebert & Brockhaus KG., Gummersbach.

Metaplast KG., Helmuth Schmoock, Reinbeck Bez. Hamburg.

Metzeler Gummiwerke AG., Latex- u. Schaumstoff-Werk, Memmingen.

Meyer, Rudolf, Ing. Waldkraiburg.

Molan-Werk Erich Dittrich, Bremen.

Mollberg & Co., Hofgeismar b. Kassel.

Mulheimer Kunststoff GmbH., Mulheim.

Muller, Fritz, "Coroplast" KG., Wuppertal-Nachstebreck.

Neuner, Wilhelm, Waldkraiburg.

Nienburger Metallwaren - Fabrik Adolf Thies GmbH., Nienburg.

Norddeutsch. Seekabelwerke AG., Nordenham.

Norvin - Kunststoff - Verarbeitung GmbH., Heilsbronn.

Novadel Ltd., London, England.

Nylon-Industrie "Helvoet" N. V., Rotterdam, Holland.

Oerderlin & Cie. AG., Baden, Switzerland.

Osterreichische Kunststoffpresswerke Heinrich Schmidberger, Vienna, Austria.

Ohler Eisenwerk Theobald Pfeiffer, Ohle.

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Phoenix-Rheinrohr AG., Vereinigte Hutten- u. Rohrenwerke, Dusseldorf.

Piller, F., Augsburg.

Plasticominum, Levallois/Seine, France.

Plasticonfection, Brussels, Belgium.

Plastiques, Paris, France.

Plasto, Hugo Honicke KG., Berlin.

Plastoform Kunststoff GmbH., Bunde-Sudlengern.

Plate & Voerster KG., Kierspe.

Plate, Dr., GmbH., Bonn.

Pleiger, Paul, Hammerthal-Nord ub. Hattingen.

Polymer - Synthese - Werk Rudolf Klaus & Co., Mulheim.

Portland Plastics Ltd., Hythe, England.

Potthoff, Karl, Solingen-Ohlings.

Press-Chemie GmbH., Regensburg.

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Rastatter Kunststoffwerk GmbH., Rastatt.

Rehau-Plastiks GmbH., Rehau.

Reisgies, Wilhelm, Opladen.

Reppel & Collman, Kierspe.

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Rheinisches Spritzgusswerk GmbH., Weissenburg.

Rhodiaceta (Dept. Nylon), Lyons, France.

Richly, Baden-Baden.

Roders, G. A., Soltau.

Rohm & Haas GmbH., Darmstadt.

Rommler, H., GmbH., Gross-Umstadt.

op te Roodt, J., Hannover-Wulfel.

Rost & Co., H., Hamburg-Harburg.

Ruhr-Plastik Wegener & Co., Dochum-Gerthe.

Saba N. V., Fabriek v. Chem. Producten, Dinxperlo, Holland.

Saran-Webereien GmbH., Koln.

Saureschutz Rheinruhr GmbH., Gladbeck.

Schafer, Fritz, GmbH., Neunkirchen.

Scheermesser & Co., Dr., W., KG. Linz.

Schmidt Alexander, Dr., Blankenstein.

Schmidt & Co., F. G., Erkelenz.

Schnackenberg & Co., Aug., GmbH., Wuppertal-Barmen.

Schneider, W., Altenkirchen (Ww.).

Schniewind, H. E., Haan.

Schroder, Joseph, Hommerich/Rh.

Schrupp & Co., GmbH., Betzdorf.

Schulte & Co., J., KG., Dusseldorf.

Schumacher, Herbert, Dusseldorf.

Schwarz, Alfred, Werk Altenbruck, Altenbruck, Post Untereschbach.

Scobalitwerk Ferd. Wilh. Wagner, Andernach.

Sidac, Soc. Ame., Brussels, Belgium.

Sieper & Sohne, Richard, GmbH., Ludenscheid.

SIS-Spezialfabrik fur industr. Saureschutz Thelen & Co., Hangelar.

Sitzmann & Heinlein, Zirndorf b. Nurnberg.

Skanska Attikfabriken AB., Perstorp, Sweden.

Sociedade Industrial de Produtos Electricos S.A.R.L., Carcavelos, Portugal.

Soc. del Gres Ing. Sala & C., Milan, Italy.

Solvic, Soc. Ame., Brussels, Belgium.

Spiess & Sohn, C. F., Kleinkarlbach ub. Grunst.

Spruyt & Co. NV. Borgerhout, Anvers, Belgium.

Stankiewicz, Dr. A., GmbH., Celle.

Steger & Co., Ernst, Inh. Ernst Steeger, Huckeswagen.

Steiger & Deschler GmbH., Ulm-Soflingen.

Stevens, Soc. Ame., Usines A., St. Nicola, Belgium.

Stiefeling, W., Berlin-Schoneberg.

Stocko, Metallwarenfabriken Hugo u. Kurt Henkels, Wuppertal-Elberfeld.

Stojkowitsch, M., Deizisau b. Esslingen.

Stokvis Kon, W. J., Fabr. v. Metaalwerken N. V., Arnhem, Holland.

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Suddtsch. Schaumstoff- u. Kunststoff-Druckerei, Peter H. Knapp, Reutingen.

Sud-Stoff, Suddtsch. Kunststoffwerk GmbH., Neustadt.

Sud-West-Chemie., GmbH., Neu-Ulm.

Tavernier, Robert, NV., Tielt, Belgium.

Tehalit Kunststoffwerk GmbH., Heltersberg.

Turnwald GmbH., Lockweiler.

Union des Syndicats de la Transformation des Matieres Plastiques, Paris, France.

Ursania-Chemie GmbH., Herne/W.

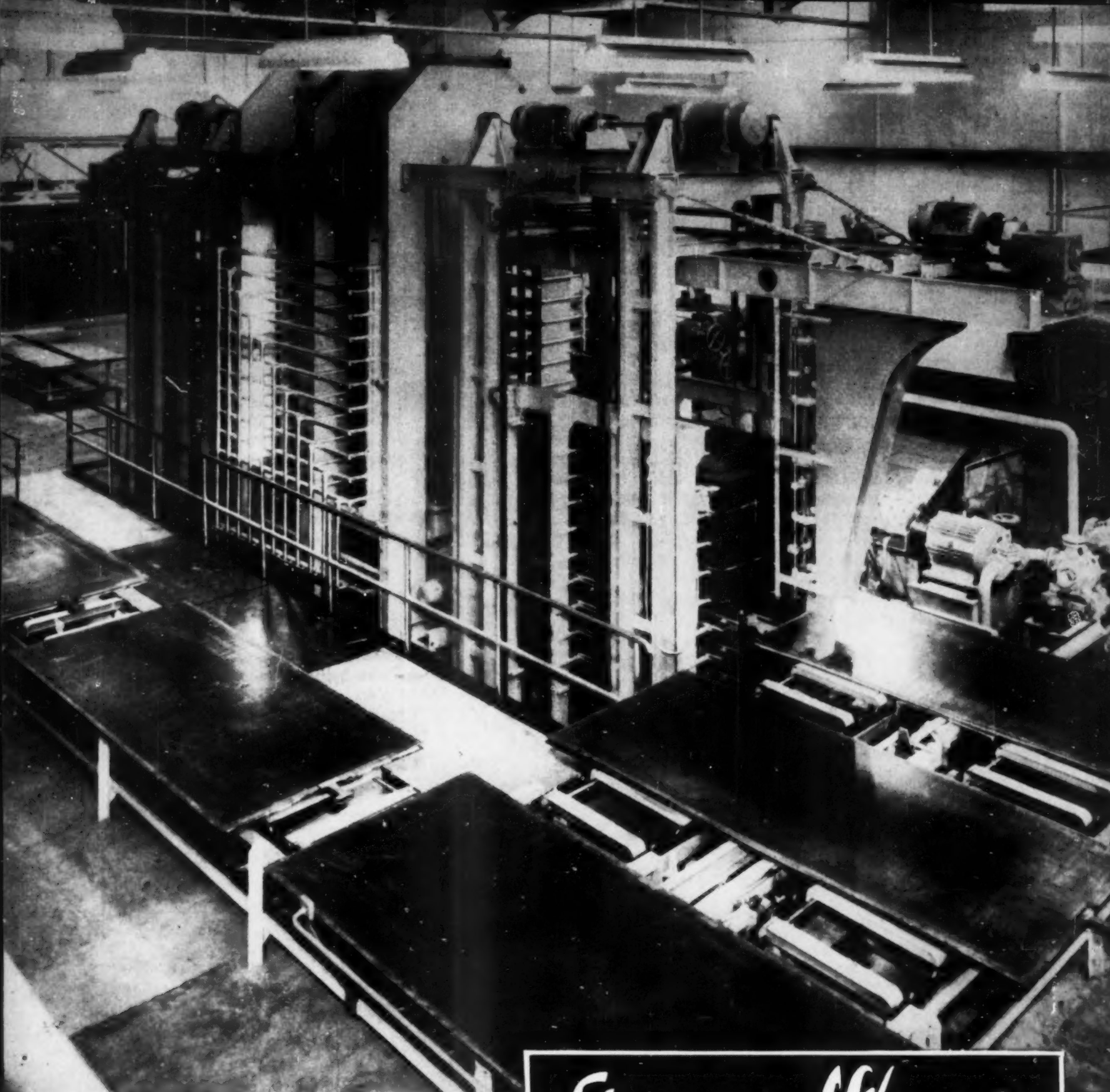
Usine Gheysen S. A., Lembeek-Halle, Belgium.

Verpackungstechnik GmbH., Eschborn b. Frankfurt.

Vowinkel, Joh. Jac., Munchen.

Vulkanfiberfabrik Grashorn & Co. Wildeshausen i. Oldbg.

Vulkanfiberfabrik Ernst Kruger & Co., KG., Geldern. **(To page 152)**



Wachstuchfabrik Griesheim KG., Frankfurt.

Walch, Heinrich, KG., Carthausen.

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Weber & Schulz, Hamburg-Bahrenfeld.

Weidling & Sohn, P. W., KG., Munster.

Weinmayr & Co., G., Wiesensteig.

Wernert & Co., H., KG., Mulheim.

Westag, Westdtsch. Sperrholzerke AG., Wiedenbruck.

Wieland-Werke AG., Metallwerke, Ulm.

Wiggins, Teape & Co., Ltd., London, England.

Wolf, Otto, Koln.

Wrede, Eberhard, Sperrholzwerk, Neheim-Husten.

Zorn, E., Trais-Horloff ub. Lich.

Machinery

Aktiebolaget Alpha, Sundbyberg, Sweden.

Alkett Masch.-Bau GmbH., Abt. Kunststoffe, Berlin-Borsigwalde.

Alpine AG., Augsburg.

A.M.U.T.-Automazione Macchine Utensili S.p.A., Novara, Italy.

Ankerwerk Gebr. Goller, Nurnberg.

Arburg Feingeratefabr. oHG., Hehl & Sohne, Lossburg.

Arendonk S. A. Brussels, Belgium.

Aust u. Schuttler & Co., Kunststoff-Ges. mbH., Dusseldorf.

Baumer, Albrecht, Freudenberg.

Barclay Stuart (Plastics) Ltd., Luton, England.

Battenfeld, Gebr., Masch.-Fabriken GmbH., Meinerzhagen.

Becker & van Hullen, Niederrhein. Maschinenfabrik, Krefeld.

Berges, C. & W., Marienheide.

Berstorff, Hermann, Masch.-Bau-Anstalt GmbH., Hannover.

Bielloni, G., Milan, Italy.

Brechmann, Willy, Schloss Holte i.W.

British Industrial Plastics Ltd. London, England.

Bucher-Guyer AG., Niederwenningen, Zurich, Switzerland.

Buhler, Gebruder, Uzwil, Switzerland.

Bullmerwerk, Stuttgart-Zuffenhaus.

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Chemica AG., Zurich, Switzerland.

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Covema s.r.l., Milan, Italy.

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Fecken-Kirfel, Aachen.

Fellner & Ziegler GmbH., Frankfurt.

F.I.M.S.A.I., S.p.A., Milan, Italy.

Fischer, Georg, AG., Schaffhausen, Switzerland.

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Herfurth GmbH., Hamburg-Altona.

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Leybold's, E. Nachf., Koln-Bayenthal.

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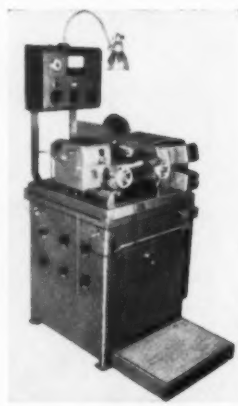
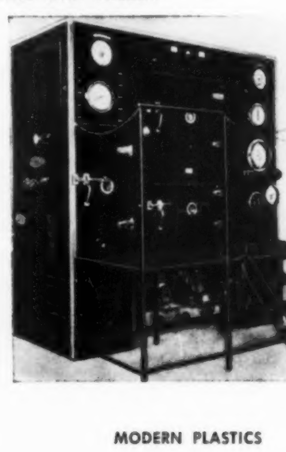




NEW DEVELOPMENTS

Many minds at work on new ways to use plastics, new designs, and new product concepts offer ideas you can use.

Laminate scores where paper fails

Cotton-phenolic laminate wedges have replaced paper counterparts as coil-positioning devices in synchro and low-inertia motors, overcoming serious problems formerly encountered with paper wedges.

PHENOLIC laminate wedge is hand-inserted into stator of 1 in. synchro. Paper wedges used previously often broke or swelled so they wouldn't fit. New wedges are tough, absorb little moisture, insure smooth production flow.

Synchro and low-inertia motors are small electrical devices (some less than 1 in. O.D.) used in great volume on aircraft to control a host of operations. The B-58 Hustler, for example, incorporates several thousand.

The wedges, ranging in length from 7/16 to 1¼ in., are hand-inserted into tiny slots cut in the stator assembly, and serve to position field coils in these slots. With increasing miniaturization, Eclipse-Pioneer Div., Bendix Aviation Corp., found that the paper wedges were crushing during insertion, tearing on the silicon-iron disks of the stator assembly, and often swelling far beyond slot size on damp days.

All these problems were overcome by switching to the cotton-phenolic material. The laminates are produced and fabricated by Taylor Fibre Co., Norristown, Pa.

The material is said to have a compressive strength flatwise of 37,000 p.s.i., and a maximum of water absorption of only 4% for 1/32-in. stock. In addition, it is compatible with the varnish and varnish solvents used to waterproof the units.

Lightest raincoat

Lightweight police raincoats, made of vinyl-coated nylon fabric, have been introduced by B. F. Goodrich Industrial Products Co., The B. F. Goodrich Co., Akron, Ohio.

The coats, available in black and yellow, are said to be the lightest ever manufactured for regulation police use. In size 42, for example, the coat weighs just 1 lb., 5 oz.; by comparison, conventional police raincoats weigh between 4 and 5 pounds.

Foam for infantry

A waterproof, fully insulating foxhole lining and cover, quickly formed of urethane foam, is yet another in the growing applications of the material. Supplier of the foam, American Latex Products Corp., subsidiary of Dayton Rubber Co., Dayton, Ohio, says it is possible for small, portable mixing machines, transported in jeep trailers, to supply enough of the material to service an entire company.

RP tops outperform canvas

Reinforced plastics hardtops for pleasure boats offer the convertability of canvas tops without many of the latter's problems. The new hardtops are weather- and corrosion-resistant, can be installed in minutes without special tools, and will last as long or longer than the boat, according to the manufacturer of the tops, Seabreez Marine Products, Sugar Creek, Mo.

Molded by Seabreez using Owens-Corning fibrous glass and epoxy resins supplied by Reichhold Chemicals, Inc., the tops are available in two models, each with four sizes, which will fit acrylic, safety glass, or wooden frame windshields. There are no wood or metal braces in the construction of the tops. Universal gunwale hardware supplied is said to fit any craft, regardless of gunwale shape.

In the de luxe model, tilt-back feature permits easy access to the forward seat. These de luxe models cost from **(To page 158)**

NEW pleasure boat hardtop of epoxy reinforced with glass fibers resists corrosion and weathering. Use of this lightweight material counters such problems as bagging, shrinking, and fading, which are difficulties often faced with boat tops of canvas.

(*From page 156*)

$119.50 for the 46-in. top to $197.50 for the 64-in. size. In the standard models, tops of the same length range in price from $98.50 to $183. Weight of the small size standard model is 24 pounds.

Redesigned in premix for lower cost

A reduction in manufacturing costs of about 5% and a design improvement expected to boost sales to new heights was achieved when The Partlow Corp., New Hartford, N. Y., switched from die cast aluminum to premix for its model MFS industrial-type indicating temperature control. This is the company's first venture into the production of plastics housings.

The savings resulted from the elimination of painting operations, a new mounting method made possible by molding the part which obviated the necessity for furnishing several mounting brackets, elimination of a rating plate, and a weight saving of about 6 oz. per unit.

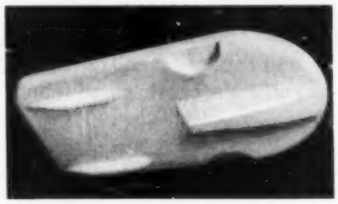
Redesign of the instrument was done by Raymond Loewy Assocs. As is apparent from the accompanying illustrations, the new unit has a much improved, modern look. By making the top of the case taper down toward the back, a major problem of adapting the instrument to flush mounting was eliminated. The taper permits the case to be inserted into an aperture in the control panel from the front, with the element projection (see photo) inserted first. A flange molded into the unit where case and cover meet provides an edge against which they can fit to the instrument panel. For wall mounting, four knock-out holes in the back surface of the case permit screw attachment to wall. Premix, supplied by Glaskyd, Inc., Perrysburg, Ohio, was selected because of high impact strength, dimensional stability, smooth texture, and stability to at least 400° F.

OLD MODEL (upper left), made of die cast aluminum with black wrinkle finish, was in service 20 years. Premix instrument is shown flush mounted (lower left); wall mounted (below).

The parts are compression molded at 320° F. Four side holes for assembly screws are drilled and tapped into finished piece.

Expanded polystyrene flotation toy

The buoyancy and excellent strength-for-weight ratios of molded, expanded polystyrene make it an ideal material for water sports equipment. The latest case in point is a kick, flutter, and paddle board introduced by Aeroplastics Corp., El Segundo, Calif.



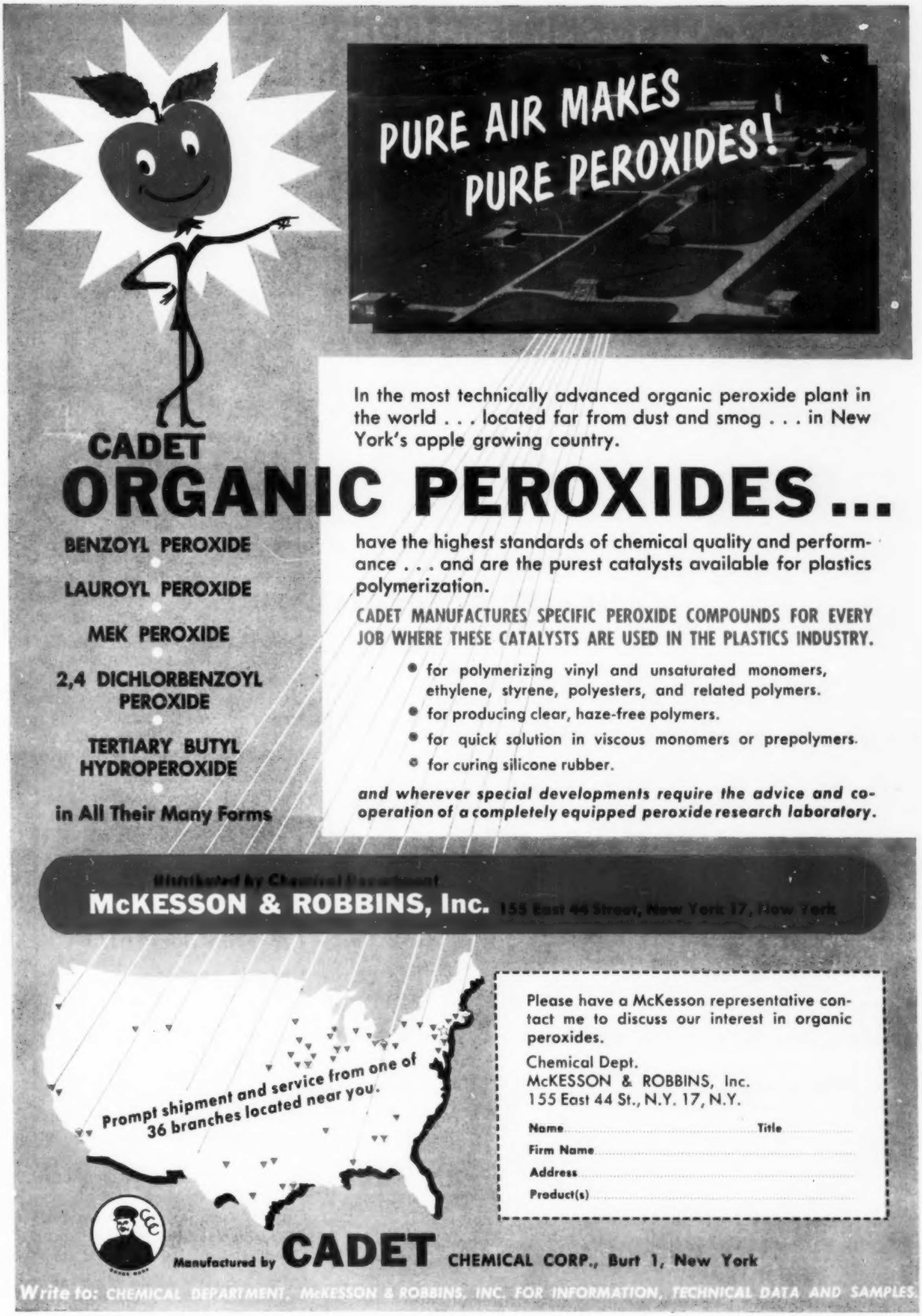
SWIM BOARD molded from expandable polystyrene is extremely tough for its light weight, provides 100% flotation. To add stability and eye appeal, molder designed board with hydroplane fins and recessed gripping areas.

Priced competitively with similar flotation products, the solid "Swim Fun Board" requires no inflating, thus ending problems of air leakage or leak patching. Salt and chlorinated water cannot rot or pit the board, or cause its bright yellow color to fade. It is said to support weights up to 200 pounds.

The polystyrene board is designed with hydroplane fins and recessed gripping areas, adding stability and eye appeal. Dylite expanded polystyrene is supplied for this application by Koppers Co., Inc., Pittsburgh, Pa.

Acetate pilot saves 90 percent

For guiding tubes through tube sheets, baffles, and support plates, lightweight tube **(To page 160)**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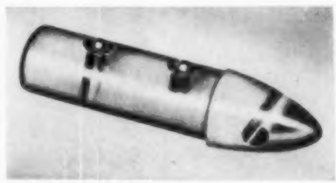
pilots of cellulose acetate match the work of heavier models, yet cost about one-tenth as much.

In the assembly of tubular equipment, the pilots are fitted over tube ends to protect them from damage and to eliminate the need to fish tubes through misaligned tube holes. The new plastic models, made by Thomas C. Wilson, Inc., Long Island City, N. Y., are designed for use with



CELLULOSE ACETATE tube pilot can do same job as heavier models; yet costs approximately 1/10 as much.

heat exchanger and boiler tubes ranging from 3/8 to 1 in. O.D.

The Wilson tube pilots sell from 90¢ to $1.10. In comparison, steel tube pilots cost approximately $8.50 to almost $10 apiece.

Two spring-pressure pins, inserted through the units, help to fit and hold the tube pilot on the tube end. A horizontal opening in the forward end of the pilot enables the tube fitter to pull it off the tube end by a nail or rod.

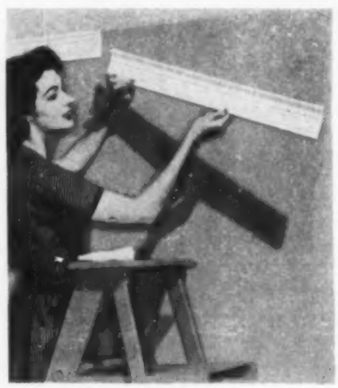
Rotuba Extruders, Inc., Brooklyn, N. Y., supplies the acetate bar stock for machining by the Wilson firm. Acetate is by Eastman Chemical.

Interior decor made easier

Decorative ceiling moldings thermoformed of rigid vinyl sheet and window cornices or valences formed of high-impact styrene sheet are two of the latest plastics applications that make home decorating easier and less expensive.

The vinyl ceiling moldings bring to the average home all the beauty of the wood and plaster moldings on which skilled craftsmen spend endless hours of labor in shaping. The vinyl material is supplied in 36-in. (To page 162)

WINDOW CORNICES, vacuum formed from styrene sheet, are designed to harmonize with the decor in any home. Twelve sizes are offered by Cornice Craft.



VINYL decorative moldings are available in seven different patterns. Moldings are made in white only, but can be painted if desired.

strips, which can be cut to exact size with scissors and cemented in place with a simple mastic. Supplied in seven different patterns by Sears, Roebuck and Co., the moldings are offered in white only but can be painted if desired. It is stated that they can be applied around a 14 by 24 ft. room, for example, for a little less than $10.

The window cornices, formed of Bakelite styrene sheet by Cornice Craft Corp., Brooklyn, N. Y., are available in 12 sizes and can be easily assembled to a simple frame. Their design incorporates fine filigree work that is stated to harmonize with traditional, contemporary, or modern decor in the home.—**End**

LITERATURE

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"Big Molecules" by Sir Harry Melville

Published in 1958 by The MacMillan Co., 60 Fifth Ave., New York 11, N. Y. 182 pages. Price: $3.95.

Beginning with the methods for the synthesis and chemical modification of representatives of big molecules, the author then describes molecular weight and the method for its determination. Separate chapters also focus on the role of big molecules and their practical application in commercial, industrial, and medical fields. Topics include: silicones; electron microscope; ultracentrifuge; osmotic pressure; method of light scattering; viscosity; dry, wet, and melt spinning; crystallization phenomena in fibers; rubber latex; extrusion techniques; fabrication of plastics; reinforced and ion exchange resins; polystyrene; polyethylene; PVC; and polytetrafluoroethylene.

"Physical Properties of Polymers"

Published in 1959 by Society of Chemical Industry, 14 Belgrave Square, London, S.W. 1, England, and The MacMillan Co., 60 Fifth Ave., New York 11, N. Y. 294 pages. Price: $6.00.

This book contains the papers read at the six sessions of the Silver Jubilee Symposium organized by the Plastics and Polymers Group, Society of Chemical Industry, which was held at the University of London in 1958. In addition to the 20 papers, there is a discussion following each talk, plus reference material, graphs, tables, etc.

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Vinyl-metal laminate. Description, uses, aging test, etc., for Colovin, a white vinyl sheeting that can be laminated to steel, aluminum, etc. 4 pages. *Columbus Coated Fabrics Corp., Columbus 16, Ohio.*

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Designer's fact book. Describes over 50 industrial Formica laminated plastic grades, including a comparator chart itemizing the qualities of the most popular grades; list of materials by military specification number; designer's information on all standard and special grades; and physical and electrical **(To page 166)**

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characteristics. 110 pages. Price: $1.00. *Formica Corp., 4614 Spring Grove Ave., Cincinnati 32, Ohio.*

Stain-resistant pearl essences. Properties of the pastes, performance characteristics, heat and light stability, sulfide staining, pearl content, price, sample of sheeting, etc., for two stain-resistant pearl essences for vinyl compounds. Technical Bulletin 50. 1 page. *Claremont Pigment Dispersion Corp., 39 Powerhouse Rd., Roslyn Heights, N. Y.*

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S.P.I. activities. Pocket-size booklet designed to acquaint members and prospective members on the functions and organization of the Society. 12 pages. *The Society of the Plastics Industry, Inc., 250 Park Ave., New York 17, N. Y.*

Polyvinyl chloride. "Rigid Geon PVC Materials" describes the properties, processing, uses, etc., of Geon PVC compounds. 32 pages. "Rotational Casting of PVC Pastes." 6 pages. "Section Extrusion of Rigid PVC." 4 pages. *British Geon, Ltd., Devonshire House, Piccadilly, London W1, England.*

Radioisotope measurements. Brochure explains how radioisotopes provide optimum quality control in continuous process operations in the plastics and other industries, including operating characteristics, applications, etc. 4 pages. *Radiation Counter Laboratories, Inc., 5121 W. Grove Ave,. Skokie, Ill.*

Heat sealer. Specifications, uses, advantages, etc., for the Comet 54 UL heat sealer, a bench-type, foot-operated unit that handles most sealable thermoplastic materials. 2 pages. *Product Packaging Engineering, 5713 Joanne Pl., Culver City, Calif.*

Mill shapes of polyether resins. Physical, electrical, and chemical properties, uses, etc., for Polypenco Penton chlorinated polyether resins. Describes all availabilities, including rod, strip, tubing, tubular bar, plate, tank linings, pipe, special castings,

fabricated parts, and coatings. 4 pages. *The Polymer Corp. of Pa., Reading, Pa.*

Vacuum Metallizing Spray Coatings. Spray coatings for use in conjunction with metallizing thermoplastics, thermosetting plastics, etc. are described, including base coats for use before metallizing and top coats and back up coats for use after metallizing. 18 pages. *Logo Div., Bee Chemical Co., 12933 S. Stony Island Ave., Chicago 33, Ill.*

Pressure switches. Specifications, operating characteristics, spare parts data, uses, etc., for a line of Meletron pressure switches—diaphragm, bourdon tube, or piston. Includes information on how to select a pressure switch, electrical rating tables; general operating, engineering, and service data; trouble shooting and maintenance; etc. Catalog PS-59-60. 36 pages. *Barksdale Valves, 5125 Alcoa Ave., Los Angeles 58, Calif.*

Premix. Properties, molding and finishing data, applications, etc., for Rockite K-501 polyester dough molding compound. Technical Bulletin T-2. 16 pages. *British Resin Products, Ltd., Devonshire House, Piccadilly, London W1, England.*

Adhesives. "Adhesives for Bonding Polystyrene to Various Materials of Construction" describes two adhesives—A-827-B and R-1083-T—designed for foamed-in-place polystyrene and for bonding prefoamed polystyrene, including properties, uses, application procedure, etc. 12 pages. *B. F. Goodrich Industrial Products Co., Akron 18, Ohio.*

Muriatic acid. History, properties, reactions, uses, handling and storage, sampling and dilution, health hazards, analysis, etc., of muriatic (hydrochloric) acid, which is used, among other things, in the production of casein plastics; as a reagent in the derivation of lignin plastics from wood; and in the resinification of furfuryl alcohol and furfural. 44 pages. *Inorganic Chemical Sales, The Dow Chemical Co., Midland, Mich.*

Silanes. Physical properties, product specifications, shipping data, chemical properties, applications, etc., for a line of 24 silanes, which include four major classes of silicon chemicals: Chlorosilanes; Organo-substituted chlorosilanes; Organosilane esters; and OrganoFunctional esters. Used to modify glass fibers, as an intermediate, etc. 16 pages. *Silicones Div., Union Carbide Corp., 30 E. 42nd St., New York 17, N. Y.*—End

Plastics Patents

(*From page 50*)

Polyepoxide coatings. H. Dannenberg (to Shell). 2,884,339.

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Dicyandiamide resins. B. Zorn and G. Manthe (to Bayer). 2,884,403.

Polyester glycol-diacrylate composition. J. A. Parker (to Armstrong Cork). 2,884,404.

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Cationic-modified urea resins. G. I. Keim (to Hercules). 2,884,407.

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Porous polyurethanes. K. Breer and E. Weinbrenner (to Bayer). 2,885,-268.—End

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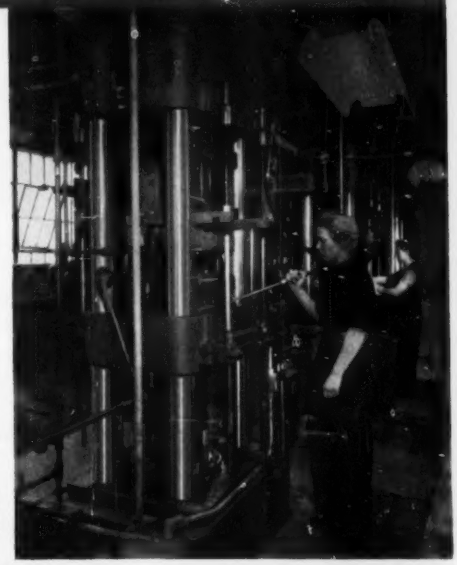

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Plastics Digest

(From page 54)

if above 3:1, did not influence the yield of isotactic product appreciably. The addition of lithium aluminum hydride to the catalyst resulted in a slight improvement of yield of isotactic polymer. In the titanium trichloridetriisobutylaluminum catalyst system, preheating the two catalyst components led to improved activity.

Stereospecific polymerization. G. F. D'Alelio and T. J. Miranda. Chem. and Ind. No. 5, 163-64 (Jan. 31, 1959). Anionic mechanisms have been proposed for the polymerization of olecatalysts by Ziegler, Natta, and others. Several monomers, including isoprene, were polymerized with alkyl aluminum-titanium tetrachloride catalysts in varying ratios from 5:1 to 1:5 of the alkyl aluminum and titanium tetrachloride. The results reveal that, when excess titanium tetrachloride is used, the mechanism is predominantly cationic and when excess alkyl aluminum is used, the mechanism may be anionic.

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British Plastics: Iliffe and Sons, Ltd., Dorset House, Stamford St., London SE1, England.

Canadian Plastics: Monetary Times Printing Co., Ltd., 341 Church St., Toronto 2, Ontario, Canada.

Chemical and Engineering News: American Chemical Society, 1155 Sixteenth St., N. W., Washington, D. C.

Chemical Engineering: McGraw-Hill Digest Publishing Co., Inc., 330 W. 42nd St., New York 36, N. Y.

Chemical Week: McGraw Hill Publishing Co., Inc., 330 W. 42nd St., New York 36, N. Y.

Chemistry and Industry: Society of Chemical Industry, 56 Victoria St., London SW1, England.

House and Home: Time, Inc., 9 Rockefeller Plaza, New York 20, N. Y.

Insulation: Lake Publishing Co., 718 Western Ave., Lake Forest, Ill.

Journal of Applied Polymer Science: Interscience Publishers, Inc., 250 Fifth Ave., New York 1, N. Y.

Journal of Polymer Science: Interscience Publishers, Inc., 250 Fifth Ave., New York 1, N. Y.

Kunststoffe: Karl Hanser Verlag, Leonard-Eck-Strasse 7, Munich 27, Germany.

Materials in Design Engineering: Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y.

Mechanical Engineering: American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

Mitt. Chem. Forschungs inst. Wirtsch: Chemisches Forschungs-institutes der Wirtschaft Osterreichs, Lothringerstr. 16, Vienna 3, Austria.

Plastics Institute Transactions and Journal: The Plastics Institute, 6 Mandeville Pl., London W1, England.

Plastics Technology: Bill Brothers Publishing Corp., 630 Third Ave., New York 17, N. Y.

Plastics World: Cleworth Publishing Co., Inc., 342 Madison Ave., New York 17, N. Y.

Poliplasti: Via Mantegna, 6, Milan, Italy.

Product Engineering: McGraw Hill Publishing Co., 330 W. 42nd St., New York 36, N. Y.

Reinforced Plastics: Craftsman Publications, 9 New Street Sq., London EC4, England.

SPE Journnal: Society of Plastics Engineers, Inc., 65 Prospect St., Stamford, Conn.—**End**

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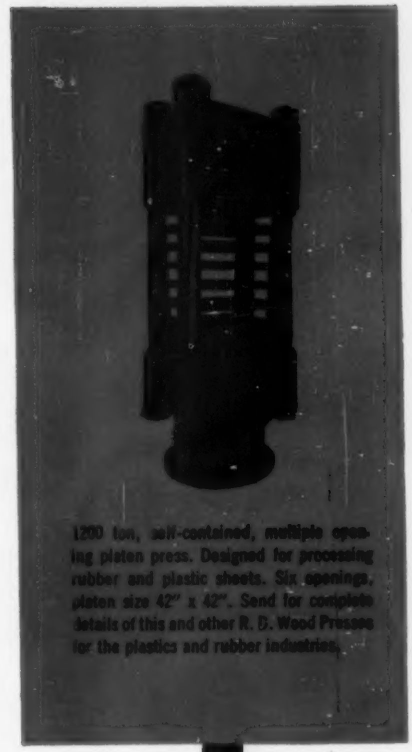

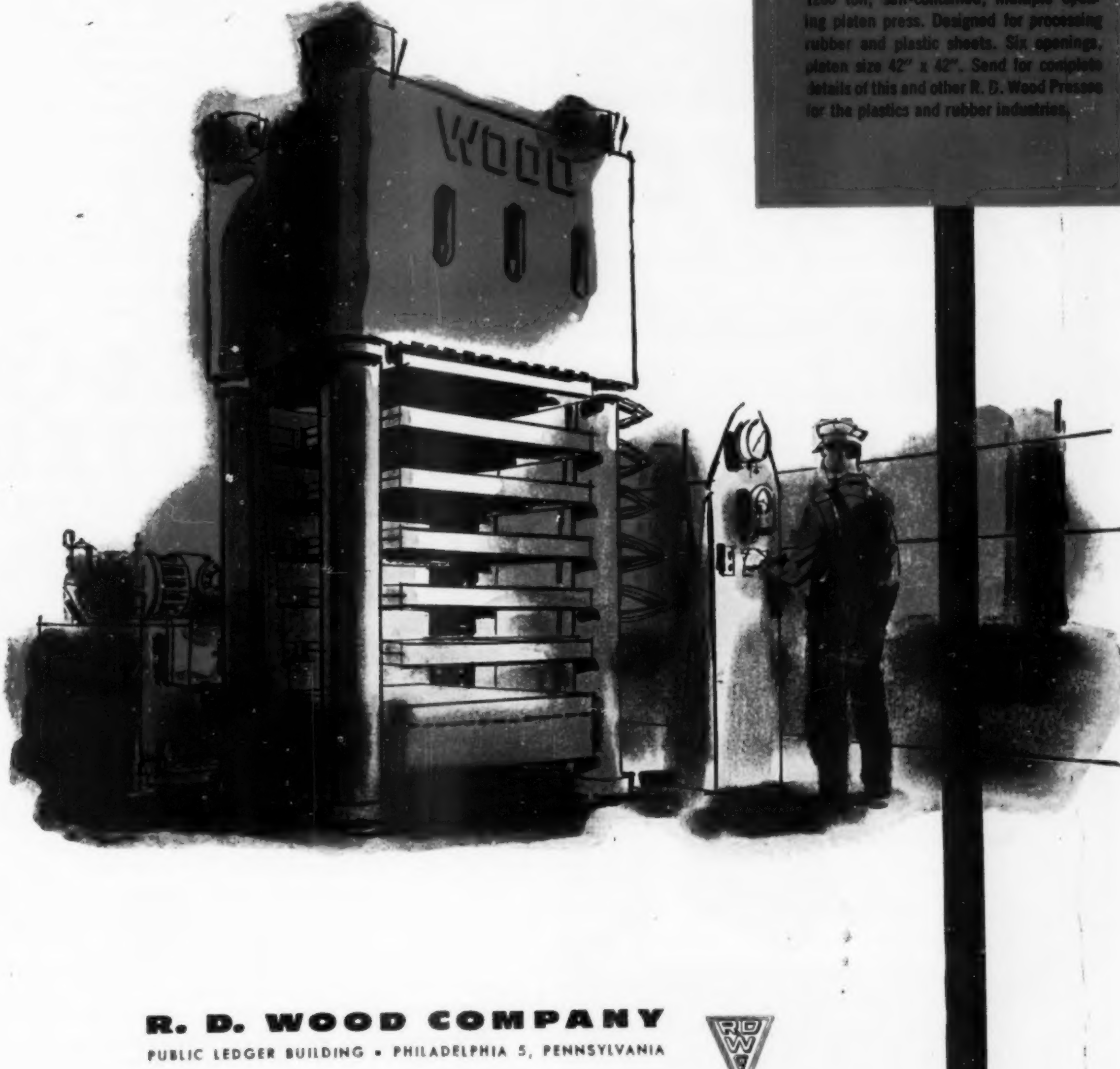

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Cost cutters

(From pp. 67-71)

a snap-fit camera lens cap that had to maintain a firm fit even under prolonged exposure at high temperatures and high humidity.

It should also be noted that Lexan is now also being used in some applications where other plastics were formerly employed but where upgrading of design and end-use requirements eliminated them from the picture.

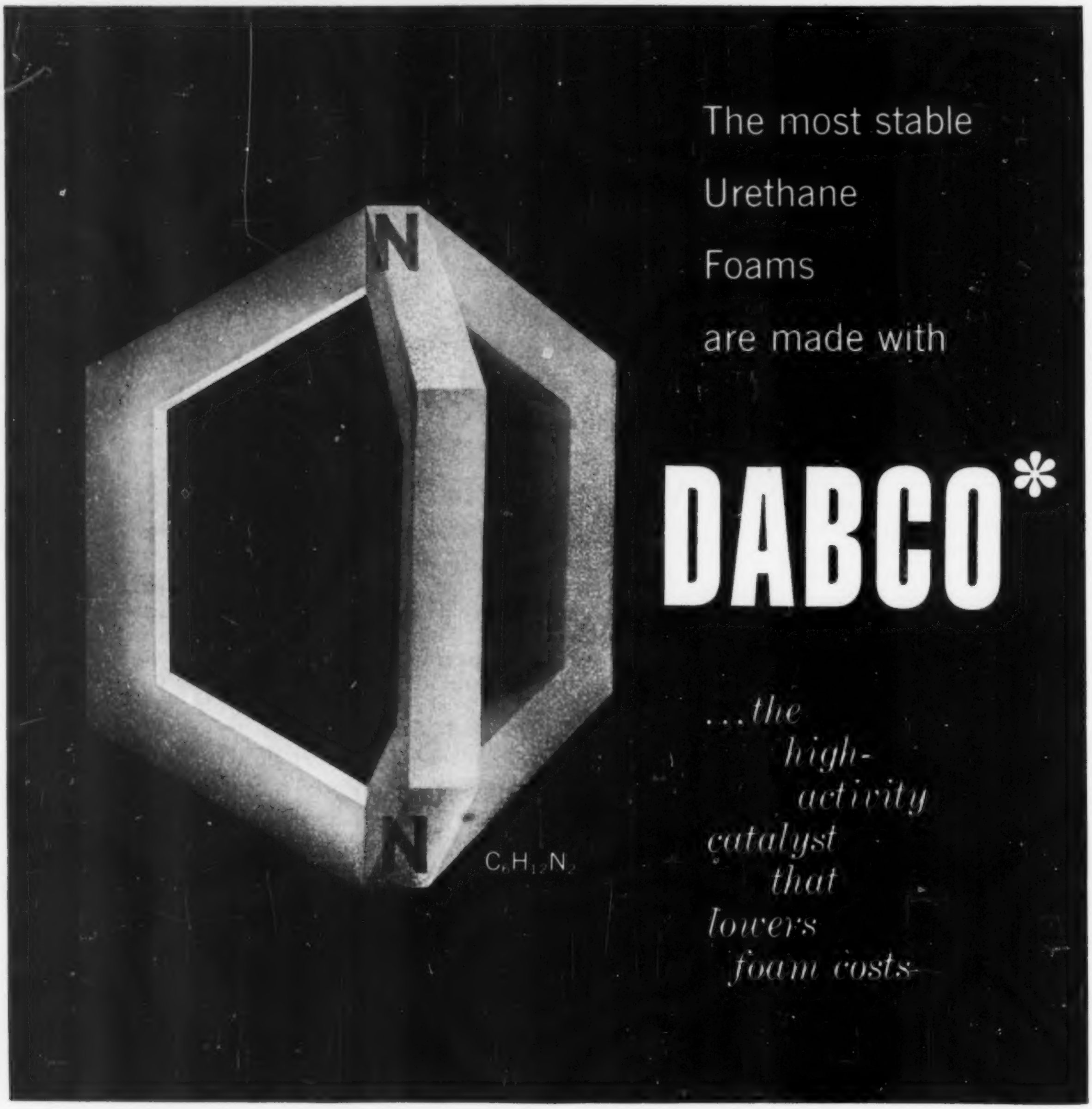
Penton chlorinated polyether

Penton is right now spiralling into the third stage of what has been a slow but effective application development program.

Originally, a major application —and still the largest end-use—was in the design of valves where Penton's exceptional corrosion resistance (comparable to nickel and better than stainless steel or most alloys), its high heat distortion point (300° F. at 66 p.s.i.) and melting point (365° F.), and its essentially zero water absorption came into play.

These Penton valves were generally made available in four versions: 1) a solid valve in which all working parts of the valve, including end-fitting (excepting the sealers) were injection molded to close tolerances; 2) valves with metal bonnet assemblies and injection molded Penton bodies (with molded-in threads); 3) metal valve shells lined with a sheet of Penton; and 4) metal valves and stems coated with 20 to 40 mils of Penton.

The advantages of Penton soon made themselves obvious. One manufacturer who supplied the valves for systems carrying everything from water to highly corrosive liquids and gases—often at elevated temperatures—reported the solid Penton valve in many instances was significantly lower in cost (more than 50%) than the glass or metal alloy valves previously required. Another user of the valves in a system where they were exposed to carbon tetrachloride, hydrochloric acid, and wet chlorine at temperatures up to 85° C. reports that they have been in operation without failure for well over 3 years. Buoyed up by results of **(To page 176)**



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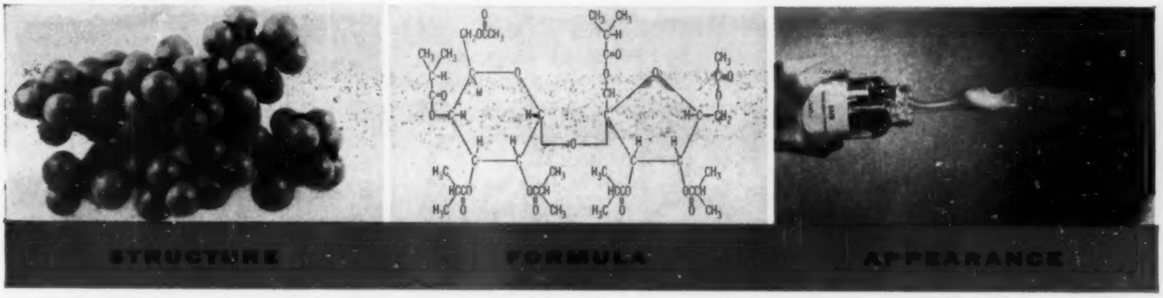

SUCROSE ACETATE ISOBUTYRATE

New Resin Modifier-Extender
produces non-fuming hot melts
extends peelable plastic coatings
improves extrusion and molding properties

Here is a new compound that warrants your investigation for its unusual physical properties.

Sucrose Acetate IsoButyrate (SAIB) is a clear, colorless semi-solid with outstanding stability to heat aging *(See Figure 1)*, ultraviolet light and hydrolysis. Less than 0.2% is hydrolyzed after refluxing in water for 4 days.

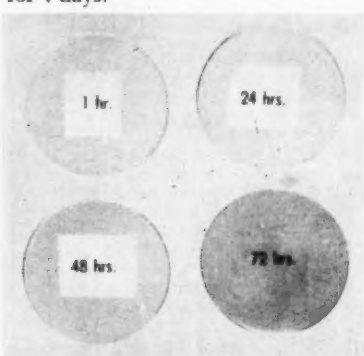

FIGURE 1. *Test specimens containing 70% SAIB, 20% cellulose acetate butyrate and 5% NP-10 plasticizer after exposure to 350°F illustrate excellent heat stability of new modifier-extender.*

It is extremely viscous at room temperature yet very sensitive to temperature change. At room temperature, the viscosity of SAIB is approximately 100,000 centipoises. Heating it to 100°C causes the viscosity to drop to only 90 centipoises.

It is compatible with nearly all polymers and modifiers and is highly soluble in most common solvents. A 90% solution of SAIB in ethyl alcohol, for example, has a viscosity of only 750 centipoises at 30°C.

With its excellent permanence, compatibility and solubility characteristics, it is little wonder SAIB is useful in hot melt and peelable plastic formulations.

Tough, flexible melt coatings can be made containing up to 70% SAIB. They have good adhesion to paper and are not tacky. One of their outstanding features is a complete absence of fuming at melt temperatures.

Modification with SAIB also lowers the operating temperature of hot melts. For example, the usual application temperature for conventional butyrate hot melts is 350°F. With high SAIB modification, the optimum temperature is down around 275°F.

In ethyl cellulose hot melt compositions, SAIB acts as a solubilizer for the mineral oil, reducing exudation of the oil from the film and enabling the formulator to use increased amounts of oil. *(See Figure 2)*

Use of SAIB in peelable coatings improves their resistance to exudation, thus prolonging their flexibility.

Recent studies show the use of SAIB with plasticizers improves their permanence along with the extrusion and molding properties of the plastics in which they are used, such as those based on cellulose acetate.

FIGURE 2. *Melt coating composition containing 70% SAIB shows no exudation after 8 months' aging at room temperature.*

SAIB is available in both a 90% strength in ethyl alcohol solution, designated *SAIB-90* and a 100% concentrate, designated simply *SAIB*.

Many more applications for this unique plasticizer-resin are being investigated by the Eastman Customer Service Laboratories. Some of the results of these studies are reported in a booklet available for the asking. To get your copy or a sample of SAIB, or both, write to Chemical Sales Development Department, Chemicals Division, Eastman Chemical Products, Inc., Kingsport, Tennessee.

SAIB

SUCROSE ACETATE ISOBUTYRATE

Eastman CHEMICAL PRODUCTS, INC., KINGSPORT, TENNESSEE, subsidiary of Eastman Kodak Company

Penton's use in valves, Hercules moved to the next obvious step—applying the material to the general corrosion-resistant chemical processing package: pipes, tanks, tubings, pumps, and fittings. Again, the same versatility in design was offered—solid parts, lined parts, or coated parts.

Now, Hercules is moving into the third stage—injection molded precision applications for industry. Here, the company feels that it not only has the physical and chemical properties of Penton to offer, but the fact that it exhibits very little shrink (about 0.003 to 0.008 per in. of width), that it doesn't warp or swell after removal from the mold, and that there are not likely to be built-in stresses because of the material's crystalline structure.

The first application—and certainly an exciting one—to be pointed in this direction is an injection molded one-piece Penton part (a "wobble plate") which is now replacing a brass disk and a carbon half-ball in a water metering system. In operation, water flowing through a slot in the disk actuates a metal pin which drives the meter. More than 75 different materials were tested before the company (Economics Laboratory) decided on Penton.

The wobble plate, which is molded to extremely close tolerances, has thus far been in service for over two years without failure. The previous metal parts failed in less than 6 months (after 100,000 gal. of hot water service, the slot in the brass plate wore away to the point where the meter ceased to function properly) and in some instances broke down after only a few days.

Encouraged by the results of this application, Hercules is now looking forward to possible uses for Penton in similar metering systems or in other applications where corrosion resistance and precision molding may be called for.

Design data available

It is obvious that much of the commentary on the three new materials may still be somewhat in the realm of supposition. While facts, figures, and test results certainly look encouraging, there is still much to be learned about the materials and the markets into which they will go. Already, each of the companies involved has developed considerable design data on the materials which is available to end-users. Fabricating and processing data are also available.

For additional data, see "Penton—a new chlorine-containing polymer," MPl, Feb. 1957, p. 150; "Polyacetal resin—a new engineering material," MPl, Dec. 1957, p. 153; "Polycarbonate resin," MPl, April 1958, p. 131; and "Working with polycarbonate resin," MPl, April 1959, p. 115.

But perhaps simply because the materials are so new, that is all the more reason why now is an appropriate time for molders and end-users to look into the materials—before their competition can develop the extra edge in know-how that may mean important profits for them in the future.—**End**

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POLYURETHANE ELASTOMER. 22-page technical bulletin on polyurethane elastomer which will not crystallize and has good creep properties, resistance to hydrocarbons, low-temperature performance, high-temperature stability and abrasion resistance. General Tire & Rubber Co. **(H-907)**

LIQUID POLYVINYL PLASTICS. Illustrated 16-page brochure discusses handling and application of liquid polyvinyl plastics that set with heat. Materials may be used by hot or cold dipping, hollow or solid casting, and knife, roller or spray coating. Bee Chemical Co. **(H-923)**

EXTRUDERS AND ACCESSORIES. Illustrated 28-page catalog describes and gives specifications for a line of extrusion machines from 1¼ inches to 12 inches. Also describes special models and a wide range of accessory equipment. Hartig Extruders. **(H-931)**

CHEMICAL CATALOG. 58-page catalog lists and describes the company's complete line and describes properties, uses and packaging. Classified as follows: Surfactants, specialties, organic intermediates, methyl carbonyls, acetylenes, caustic potash, ethylene oxide and glycols. General Aniline & Film Corp. **(H-935)**

RIGID VINYL FOR EXTRUSION. 12-page illustrated brochure presents design advantages, chemical immersion data and applications for two unplasticized compounds, consisting of high molecular weight polymers compounded with stabilizer, lubricant and pigment. B. F. Goodrich Chemical Co. **(H-940)**

Any of the booklets described here, plus many others—forty-four in all—are available for the asking, without charge or obligation. Just turn to the Manufacturers' Literature Page in this issue (it's printed on heavy paper), circle the numbers corresponding to the booklets you want, fill in the reply postcard, and mail. No postage needed. We'll see that your requests are routed promptly to each of the companies involved.

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Premix switch

(From page 72)

design and reducing development and manufacturing costs. From the design and assembly standpoints, one big advantage of the premix material is its excellent dielectric properties, which make it possible to reduce the size of the switch compartment, first by eliminating the necessity for providing the full ½-in. minimum clearance to ground from any current-carrying part as required by NEMA standards; and, second, by permitting closer spacing of the contacts. The non-conductive housing not only minimizes the chance of arc-over under humid conditions, but also adds a safety feature by preventing accidental grounding through the case when the switch contacts are being set during operation.

Because the housing is its own insulator, all electrical components could be installed directly in the material. This eliminates the need for insulating bushings, terminal strips, fiber spacers, etc., which were required in the cast-iron housing of the old model. This factor alone reduces assembly time by about 15 percent. In addition, except for tapping screw holes, the machining, buffing, finishing, and painting required for the cast-iron housings of the old switch were completely eliminated.

Molded polyester and die cast aluminum were the two alternatives considered for the housings. However, a comparison of costs, development time, and physical properties swung the decision in favor of the plastic. Owing to the economical low-pressure (300 to 500 p.s.i) molds possible with Thermaflow premixes, the total mold costs for all the housings was \$3500, compared with an estimated \$15,000 for dies for aluminum castings. An additional \$3000 to \$4000 was saved, since the molds could be built without preliminary hand-made models of the parts.

This is another in the growing roster of successsful applications for premix in the electrical field. The trend seems to be toward an increase in this type of application.—**End**

Detergent bottles

(From pp. 73-75)

time bottle prices are expected to decline.

Until recently, most high-density PE was susceptible to stress cracking by detergents. In fact, until recently the above mentioned Hercules material was the only one approved.

Recently, the other manufacturers listed in Table I have come out with special grades aimed particularly at the detergent field. All claim levels of stress crack resistance that are of high order.

Phillips, and its licensees listed in the table, developed their resin by copolymerizing ethylene with 1-butene, which had the effect of adding some branches to the molecules, resulting in a density 0.950 (as against other Marlex resins with densities of 0.960).

Tests conducted by Phillips on stress cracking indicate a shelf life of several years before any of the bottles cracked. (This estimate is based on accelerated stress cracking tests and represents a projection of the results obtained in these tests. However, these projections are not altogether conclusive.) Phillips also feels that the fact that its branching is achieved by the addition of butene will permit ready modification of formulations to meet new demands.

Union Carbide's DMD-3005 is a slightly branched resin of the Ziegler type, with the branching designed into the PE resin. Its stress crack resistance is essentially similar to that of the Phillips material. Without going into details of tests conducted by UC, the anticipated shelf life is also several years.

The outlook

As is often true in new market alignments, many of the developments are highly confidential and not for publication. For example, who supplies resin to which molder for what detergent maker cannot be stated; how big are the orders being placed; who is switching from what to what resin; and so forth. One fact, however, seems incontrovertible: high-density PE has breached a truly fabulous market.—**End**

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Polyolefin films

(From pp. 97-100)

conditions that were used with film produced by tubular or water-bath methods. This finding was made in tests conducted in the actual fabrication of bags and in the sealing of the bags by hand sealers following the packaging operation. The films produced were readily sealed on conventional bag machines with satisfactory sealing characteristics in both the transverse and the machine directions, with temperature ranges of approximately 75° F. Films with a higher degree of machine-direction orientation required slightly elevated temperatures (ca. 25°) for satisfactory sealing in the machine direction. The temperature range for satisfactory seals, however, remained about the same.

12) Drawing the film across either die lip during extrusion tended to impair the film characteristics during extended production runs (over 24 hr.) due to the drag of the film over the inevitable polyethylene build-up on the die lips. We totally eliminated this problem by drawing the film vertically downward parallel to the die lands and tangential to the surface of the chill roll. This is an important reason for avoiding non-vertical extrusion in making film by the chill-roll process.

13) Good gage control was achieved in a range of film widths from 24 to 41 in. and in gages from 0.5 to 4.5 mils. Representative crosswise profiles taken from production rolls ranging from 1 to 3 mils in thickness showed gage variations that were closely in proportion to the gage itself. The 1% confidence limits as estimated from these samples are ±12.6% from the average thickness. For 1-mil film, for example, this figure means that over 99% of the entire production will gage between 0.87 and 1.13 mils. Over entire rolls, of course, the variation was much smaller, with yields deviating no more than ±1.5% from the theoretical on runs exceeding 1000 lb. of one specific resin, gage, and width.

14) The proximity of the die lip to the contact point of the film on the first chill roll was not nearly as critical as we had thought. Satisfactory film characteristics and gage control were achieved with distances up to 5 inches. (See, however, Item 5, p. 100.)

15) The problem of "blistering" or "puckering" generally associated with roll-chilled films was easily eliminated by achieving a proper balance of chill-roll temperatures and the specific lineal speed and gage of the film being extruded. No appreciable puckering was observed at speeds under 150 ft./min., but the problem became more serious as the speeds were increased from 150 to 250 ft./min. More puckering was also observed when the first chill roll was operated in the temperature range of 40 to 125° F. This puckering was reduced as the temperature was gradually increased to an optimum point where no puckering was observed. The specific temperatures required in any specific installation

depend to a large degree upon the lineal speed and gage, the degree of wrap around the chill rolls, and the chill roll diameter. There was no loss of clarity or gloss in film produced at speeds up to 220 ft./min. With chill roll temperatures in excess of 180° F., puckering was totally eliminated, but there was a reduction in film clarity and strength.

16) A uniform "frost line" was readily maintained on the first chill roll. An irregular frost line would indicate a non-uniform gage and would inevitably result in puckering and variations in the degree of biaxial orientation.

17) Spreader rolls of either the "slat expander" or the "bologna" (Mount Hope) type were unnecessary if all rolls in the wind-up were properly aligned and good film gage was maintained. Spreader rolls of either of the two types can be employed to achieve a satisfactorily finished film roll when machine alignment and gage control are poor. If, however, the film is subsequently printed at high speed, stresses which spreader rolls tend to set into the film are relieved during passage through between-color driers or ovens on the press. Such stress relief distorts the printed design.

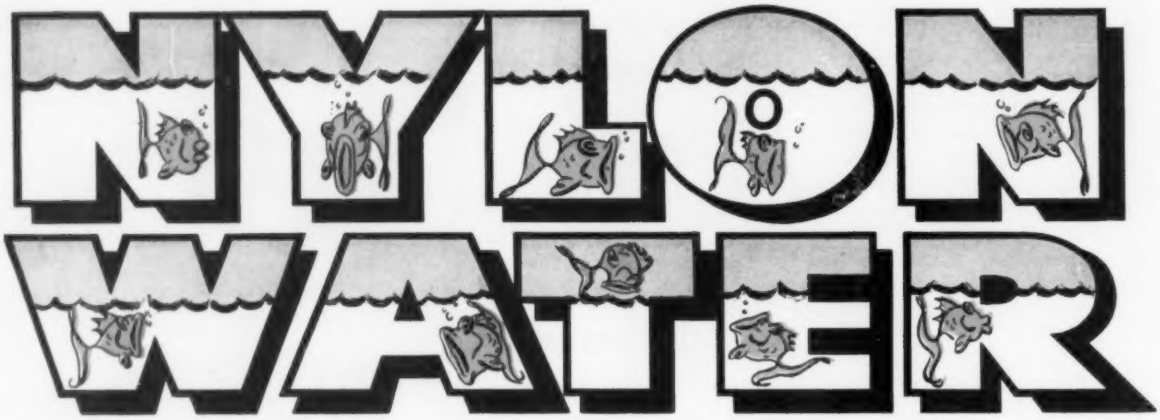
18) Trim scrap and start-up scrap rolls produced during extended runs of cast film were repelletized and re-extruded. We found that the film produced from 100% repelletized scrap could not be distinguished from that produced from virgin resins. Of course, extreme care was taken to keep the scrap clean.

19) Tests were made with several foreign firms to evaluate the possibility of upgrading various lots of "off-grade" or second-grade resins. Films extruded from these off-grade lots by either the blowing or the quench-water method were cloudy or milky and definitely unacceptable by commercial standards. When these same off-grade resins were cast, a film with satisfactory clarity and gloss was obtained.

High-density PE and PP

When linear resins of 0.95 to 0.96 density were extruded onto chilled rolls, films (To page 188)

How Much Is



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were much more isotropic and had higher impact strength than those produced by extruding into a water bath. However, the cast films were not quite as clear as those produced in a water bath with the die lips extremely close to the water surface. To cast films of high clarity from these high-density resins will probably require specially designed dies that can be placed so close to the roll that lip-to-roll distance will be about ⅛ inch.

Casting speeds up to 135 ft./min. were readily attained, though it appeared that slight modifications of the chill rolls or the addition of an air knife might be required at higher speeds to eliminate a puckering tendency.

Linear polyethylenes of approximately 0.96-density showed a tendency to "pin hole" with a short barrel (13:1 L/D ratio) extruder; this characteristic could not be eliminated by either building up the screen pack or increasing the detention time in the barrel. Minimum L/D ratios of 20:1 are evidently required for successful extrusion of such materials. Die temperatures in the range of 650 to 700° F. were required.

Linear polyethylenes of 0.94 to 0.95 density proved promising in casting operations as the film produced had greater impact strength than those from 0.96-density linear resins.

Gage variations were about the same as with low-density resin, on both water-quenched and roll-chilled linear-polyethylene films of 1- to 2-mil gage. The neck-in of linear PE was approximately 50% greater than that of low-density PE produced with the same die.

The polypropylene films produced had a cellophane-like clarity and an impact strength comparable or superior to those made of low-density polyethylenes. Extruder barrel lengths of at least 20 diameters are, however, required for successful extrusion of polypropylene, with die temperatures up to approximately 600° F. Roll-chilled polypropylene films were produced in gages from 0.7 to 2 mils with local variations comparable to those found with the PE resins.—End

Gas transmission

(From pp. 107-116)

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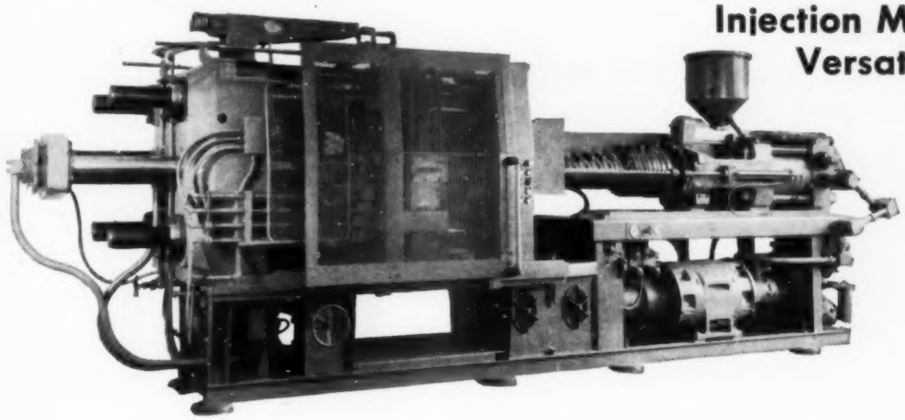

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POLYURETHANE ELASTOMER. 22-page technical bulletin on a polyurethane elastomer which will not crystallize and has good creep properties, resistance to hydrocarbons, low-temperature performance, high-temperature stability and abrasion resistance. General Tire & Rubber Co. **(H-907)**

TESTING EQUIPMENT. Several bulletins, some illustrated, describe an impact tester, low temperature test equipment, rubber durometer, and hardness and softness testers. Testing Machines, Inc. **(H-908)**

SLITTER AND REWINDER. Illustrated 4-page brochure describes a machine which slits and rewinds pressure-sensitive cellophane, polyethylene-coated cloth, etc. Slits special widths in increments of 1/64ths. Two models, 6" and 12" max. widths. 180 ft/min. max. speed. John Dusenbery Co. **(H-909)**

STRIP COATING LINE. Illustrated 4-page brochure describes machines in a production line that apply plastics, resins, etc. to coiled steel, tin-plate, aluminum and others before forming. Up to 60" width. Thickness from 1/10 mil. to 20 mils. Schematic drawing of line. John Waldron Corp. **(H-910)**

SLITTING, REWINDING MACHINES. Illustrated 6-page brochure describes line of slitting and rewinding machines, with working widths from 20 to 64 inches. Also describes a laminating machine, a gummed strip laminator, a separate unwind stand and a re-reeling machine. Inta Roto Co. **(H-911)**

INJECTION MACHINES. Illustrated 16-page catalog describes and gives specifications for a line of horizontal injection molding machines, capacities 30-50 grams to 100 ozs.; and vertical machines from 1½-3 ozs. to 32-48 ozs. Also describes three compression and transfer molding presses with 50, 175 and 350 tons clamping pressures. Improved Machinery, Inc. **(H-912)**

INDEXING TURNTABLES. Data sheet describes a turret carrying six air-operated mold holders for use in molding polyethylene bottles at rates up to 900 per hour. Eisler Engineering Co., Inc. **(H-913)**

INDUSTRIAL CHEMICALS. 6-page brochure lists and states the applications for a line of adhesives, cements, coatings, lacquers, and inks. Folder describes technical assistance available. Flexabar Corp. **(H-914)**

ELECTROFORMING SERVICE. Technical data sheet outlines applications in which electroforming can eliminate costly machining while holding close tolerances and solving problems imposed by unusual shapes. B. & E. Electroform Co. **(H-915)**

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PLASTISOL COMPOUNDS FOR ROTO-CASTING. Illustrated 4-page technical data brochure discusses the applications and advantages of three different plastisol compounds in roto-casting applications. Describes formulations based on each. Goodyear Tire & Rubber Co. **(H-917)**

MOLDING PRESSES. Illustrated 4-page brochure describes a line of molding presses in 5 and 7½ HP models which operate at up to 1200 cycles per hour. Captioned cutaway drawing and specifications. Guy P. Harvey & Son Corp. **(H-918)**

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plastics that set with heat. Materials may be used by hot or cold dipping, hollow or solid casting, and knife, roller or spray coating. Bee Chemical Co. **(H-923)**

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WIRE INSULATING EXTRUDER. Illustrated 4-page brochure describes an extruder coating any wire size with "Teflon" tetrafluoroethylene resin, using interchangeable cylinders of 1", 1½", 2", 2½" and larger. Produces at 3 times the speed of former model. Jennings Machine Corp. **(H-937)**

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RIGID VINYL FOR EXTRUSION. 12-page illustrated brochure presents design advantages, chemical immersion data and applications for two unplasticized compounds, consisting of high molecular weight polymers compounded with stabilizer, lubricant and pigment. B. F. Goodrich Chemical Co. **(H-940)**

HIGH-SPEED CUTTERS. 8-page illustrated brochure describes this company's lines of automatic machines for cutting plastic materials, rubber, textiles, etc., without distortion, whether they are hot, cold, wet, dry, or sticky. Wink Div., The Motch & Merryweather Machinery Co. **(H-941)**

EPOXY PLASTICIZERS. 4-page technical bulletin describes three epoxy plasticizers, designed to give vinyl compounders high protection against heat and light deterioration. Emery Industries, Inc. **(H-942)**

ELECTRIC CARTRIDGE HEATERS. Illustrated catalog sheet describes features of a line of electric cartridge heaters for stud heating, stress-relieving, extruding metals, and metal forming. Includes specifications, prices. Edwin L. Wiegand Co., Inc. **(H-943)**

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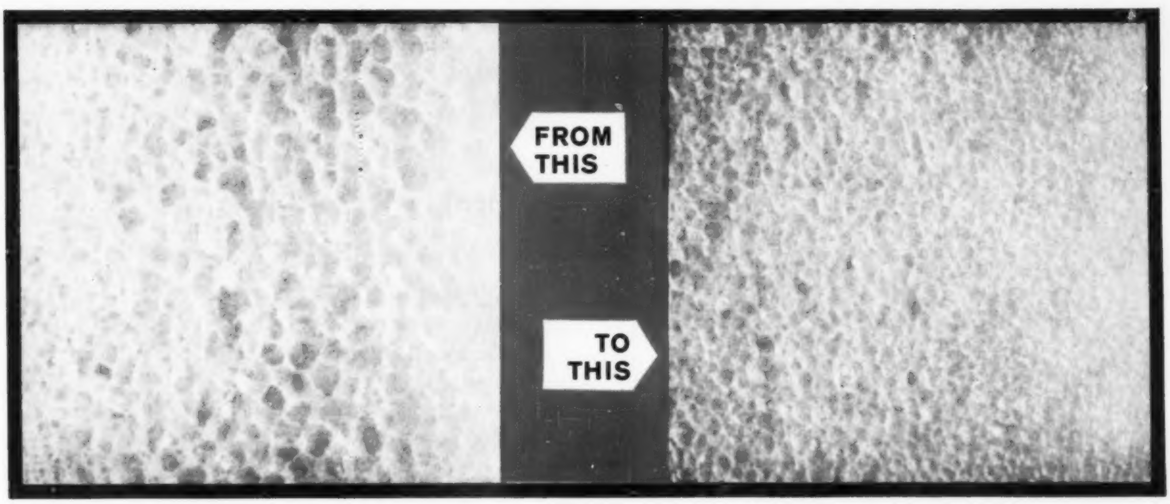

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Ultraviolet absorbers

(From pp. 119-121)

tion of the ultra-violet spectrum (10). Because the 2-hydroxy-4-methoxybenzophenone absorbs quite strongly in this section of the ultraviolet spectrum, it provides the best protection at the lowest cost to the polyester product. Figs. 4 and 5, p. 121.

Polystyrene louvres that cover fluorescent lighting fixtures turn yellow with time. Ultraviolet absorbers have so improved the color stability of styrene that the Building Research Institute has accepted this material for use in building illumination (11). Small amounts (0.25 to 0.50%) of monohydroxybenzophenones retard yellowing and have little effect on the crystal clarity of this plastic.

The benzophenone types have been shown to be effective in ethyl cellulose (12), polyethylene (13, 14) and polyurethane plastics (15). The embrittlement of cellulose acetate by light is retarded by absorbers (4).

When treated with 2,2'-dihydroxybenzophenones, synthetic fibers, especially nylon and acetate rayon, retain their tensile strength much longer in outdoor use (16, 17). Before these absorbers can solve this textile problem practically and economically, however, new techniques for their application to fabrics and fibers need to be developed.

Experimentally and commercially, colorants in plastics have been protected against fading (7, 18). Protection, however, varies from virtually none at all to five- or sixfold increases in length of time for fading. Whether fading can be inhibited by ultraviolet absorbers depends to a great extent on the colorant and to a lesser degree on the plastic.

Ultraviolet absorbers in wood-coating lacquers and varnishes inhibit darkening of the wood (7, 19-23). These coatings have included nitrocellulose, ethyl cellulose, cellulose acetate and acetate butyrate, acrylic, and oleo-resinous bases. Materials packaged in glass bottles can be protected against ultraviolet attack by coating the bottle with polyvinyl chloride plastisols that contain ultraviolet absorbers (24, 25).

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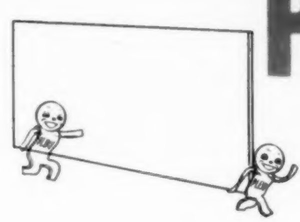

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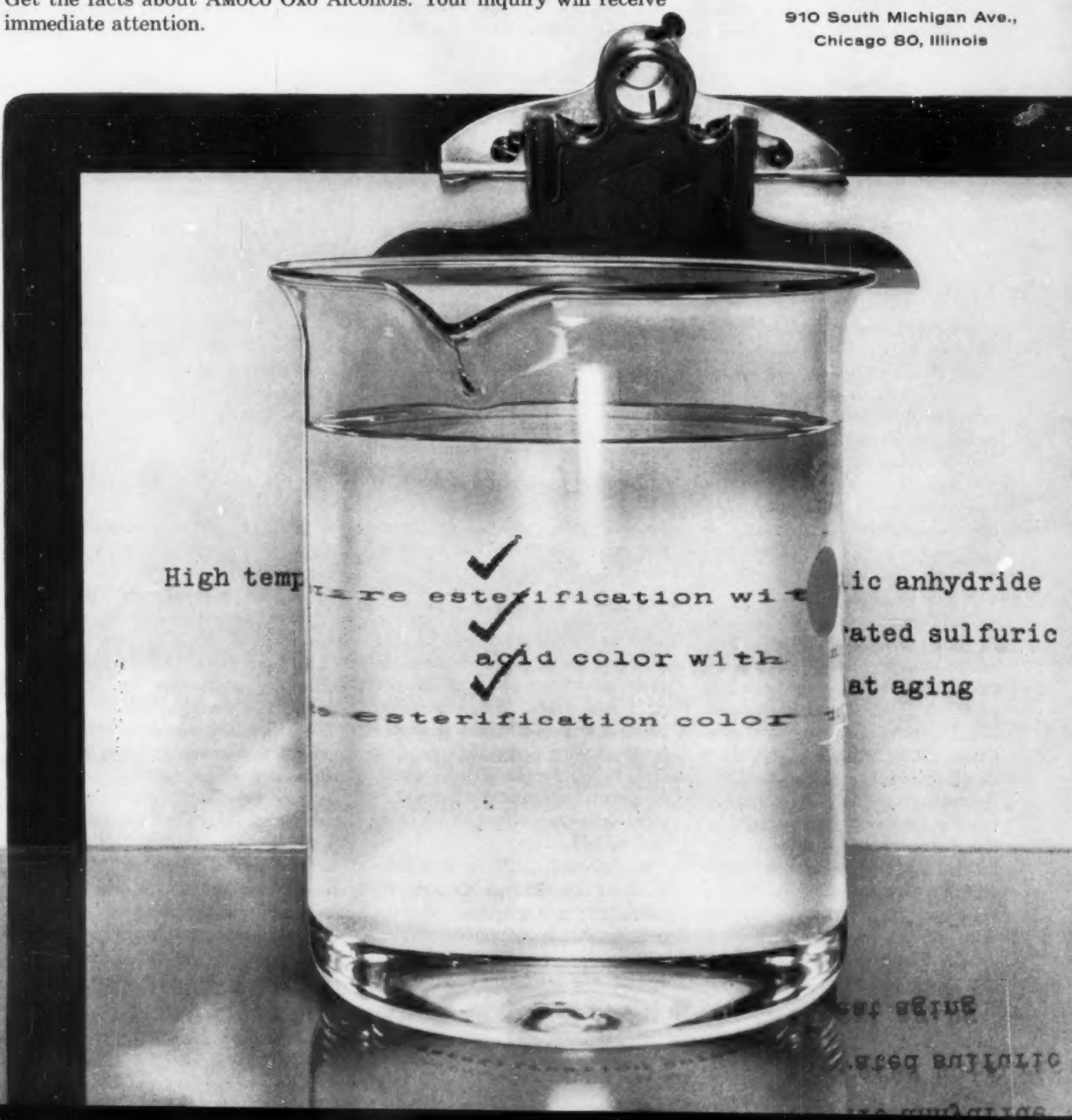

THE PLASTISCOPE*

News and interpretations of the news

By R. L. Van Boskirk

Section 2 *(Section 1 starts on p. 35)*

August 1959

Why PE continues to grow

Almost daily, new uses for polyethylene come onto the market. Some of the typical uses in a variety of applications that have been announced recently, follow. Sometimes they are unusual applications, such as the 45,000 sq. ft. wall of Visqueen PE film, which was used to alleviate the seepage problem of a temporary levee erected near West Terre Haute, Ind., when heavy rains turned the banks of the Wabash into a churning lake earlier this year. The waterproof film made by Visking Co., Div. of Union Carbide Corp., was draped up the side of the levee and enabled workers to reinforce it against the threat of further flooding.

But many of the new applications will soon be standard items.

Food packaging in PE now literally includes everything from soup to nuts. Roasted or raw peanuts, manufactured by Sachs' Nut Co., Minneapolis, Minn., are packaged in Visqueen bags, fabricated and printed by the Clear Bag Co., Minneapolis, because the nuts remain fresher, the film costs less than most other packaging materials, and the shelf life of the product is increased substantially because there is relatively no breakage of bags.

Tortillas and tamales made by El Popo Tortilla Factory, Inc., San Antonio, Texas, which produces 25,000 tortillas per hour, has switched from wax bags to cast PE. The bags are made by Texas Plastics Co., Elsa, Texas, using U. S. Industrial Chemical Co.'s Petrothene resins. The company reports that wax paper bags, at $10 per thousand, were good only for overnight protection, whereas cast PE bags costing $8.00 per thousand, keep tortillas fresh on store shelves for four days—and longer if kept in the freezer display. Texas Plastics uses the chilled extrusion method to produce 1¼ mil film from medium density Tenite resins, supplied by Eastman Chemical Products, Inc. Virtually no instances of breakage are said to have occurred in more than one million bags made from this film, and used to pack carrots produced by David Freedman & Co., Inc., El Centro, Calif. The strength of this material is reported to have speeded packaging operations by 15 to 20 percent.

The strength and uniformity of clear PE film is also said to make it well suited to the kind of high speed automatic handling methods employed in packaging hops. A technique which involves double compression of the hops for high density packaging has been introduced to the brewing industry by the A & S Re-Compressing Co., Wapato, Wash., using PE film manufactured by Visking Co. More than half a billion barrels of beer and ale have been produced from hops shipped all over the world in this material.

An increase in phonograph records sold in PE packages was forecast by Nason Allen, stock products manager of The Dobeckmun Co., Cleveland, Ohio, Div. of Dow Chemical Co. About 13% of records sold in 1958 were packaged in PE. Mr. Allen predicted that this would rise to 17% in 1959 and to over 50% within the next five years. The anticipated increased use of PE is attributed to the rising percentage of disk sales in self-service outlets, where it provides greater protection from pilferage, dust, switching, and mishandling.

A custom made PE cover manufactured by Canton Containers, Inc., Canton, Ohio, was used to package a locomotive to protect it from dust, dirt, and salt spray during the over-water shipment to Latin America. The company reports that it has made polyethylene covers for virtually every other kind of machinery, and that this application was not too unlike many other special orders.

Building construction can consume enormous quantities of PE film, as was demonstrated when one of the nation's largest extruders of this material decided to use its own product in constructing its new headquarters building. In the New York City skyscraper that Union Carbide Corp. is putting up, 2 million sq. ft. of Visqueen 2-mil PE film was used as a concrete curing agent, with an additional quantity of 6-mil film used as a water vapor barrier. These quantities are reported to be enough to pave a foot-wide path from New York City to Buffalo—a distance of 371 miles. The film provides lower cost, greater flexibility, lighter weight, and more varied width than reinforced paper and similar agents.

Seamless sheet 40 ft. wide, manufactured by the Gering Plastics Div. of Studebaker-Packard Corp., is expected to find wide use as a blanket for the curing of cement concrete. The sheet is sufficiently wide to cover three lanes, plus shoulders, of newly-laid highway pavement. The one-piece PE sheet is produced in thicknesses up to 6-mil in standard rolls 100 ft. long in natural-clear and black. Longer length rolls are obtainable on special order. The seamless construction also makes this sheet suitable for enclosing or covering large structures and areas, such as greenhouses, swimming pools, tennis courts, stadium seats, and playing fields. It is already finding service as a silage cover for trench, bunker and stack silos, and as a liner for irrigation ditches and ponds on farms, nurseries, etc. Gering has also developed heavier gages up to 10- **(To page 206)**

*Reg. U.S. Pat. Off.

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mil thickness and up to 32 ft. in width for industrial and agricultural service.

Telephone cables for the U. S. Signal Corps are now using Bakelite high-density polyethylene DGD-4100 as insulation. Designed for use in a variety of rugged environments, it will be used in connection with portable switchboard equipment which can be air transported. The added stiffness of this high density material enabled the extrusion of thinner walls, which resulted in a smaller more easily portable and installed telephone cable than was possible with previously used materials.

PE foam is now being made into products by Toyad Corp., Latrobe, Pa. Designated Chemfoam E, the low density material should be of interest in buoyant applications. Its relative inertness to a variety of chemicals is expected to provide a solution to many industrial and automotive gasket problems.

Uninterrupted extrusion of 48-in. PE plate in thicknesses up to 1⅛ inch is now possible with automatic equipment designed and built by engineers at Westinghouse Electric Corp.'s Micarta Div., Hampton, S. C. After undergoing tests for several months, the extrusion equipment is now being used for quantity production of the plate.

In providing sheet polyethylene, this new extrusion equipment is expected to aid the further development of nuclear reactors, since PE can be used where the excessive weight of concrete limits its shielding applications. The capacity of the equipment, which can be upped considerably in the future, is about 6 million lb. of 48- by 96-in. plate per year.

More colorful paint brush handles are being made from Phillips Chemical Co.'s Marlex by Stelray Products, Inc., Shelton, Conn. Because they can be injection molded in mass quantities, plastics handles are more economical than wooden ones, and their flexibility adds an element of comfort.

Colorfully printed polyethylene pennants as sales aids for oil companies and gasoline dealers are reported to have resulted in a 25% sales gain. The pennants, previously made of cloth, are produced by the Flexible Packaging Div. of Continental Can Co., and are distributed by Bower Co., Culver City, Calif. The designs are printed in high gloss inks on high gloss PE and the pennants are reportedly lasting over 3 months under the severest weather conditions.

M. A. Olsen

With deep sadness, MODERN PLASTICS announces the untimely death of its own "Ole" Olsen. Seriously ill for the last three months, he passed away in New York on July 6. He was 54.

For a year, prior to his illness, Mr. Olsen had been a vice president of Breskin Publications, Inc., publishers of MODERN PLASTICS and MODERN PACKAGING, and general manager of the business staff. But he was best known for the work he loved, in the field, as a friend and counselor to hundreds of companies whose advertising accounts in the two magazines he handled with a deep personal interest. Few men in the plastics and packaging fields were more widely known or more universally respected.

Mr. Olsen joined Breskin Publications, Inc. in 1935, when the two magazines were fledglings, and for 24 years was a key factor in their progress and growth.

Born in New York, N. Y. and educated at Cooper Union, he had been assistant advertising manager of the National Lead Co., and later headed his own advertising agency, serving many accounts in plastics and packaging.

"Ole" (he always concealed his first name, which was Marvell) was a Plastics Pioneer and a member of The Society of the Plastics Industry, Inc., the Society of Plastics Engineers, and the National Industrial Advertising Assn.

He leaves his wife, Edna, and a son, Andre, who was graduated in June from Rutgers University. He also leaves an irreparable void in this organization and in the hearts of his friends.

Phenolic to withstand 500° F.

A silane modified phenol-formaldehyde resin, which retains its strength after exposure to temperatures of 600° F. for hundreds of hours, is available commercially from Monsanto Chemical Co.'s Plastics Division.

The new material, tradenamed Resinox SC-1013, was developed especially for use with fibrous glass and asbestos reinforcements to make radomes for supersonic aircraft. Because of its excellent performance in the 500 to 600° F. temperature range, it is expected to be used in other applications where such temperatures have prohibited the use of plastics.

Late last year the company announced the development of a special phenol-formaldehyde resin, Resinox SC-1008, to protect missile nose cones against the super high temperatures, well above 10,000° F., generated by friction during the short period they are plunging through the earth's dense atmosphere from high altitudes.

Both products are the results of a special research program to develop materials for aircraft, missile, and rocket parts, and components at the company's resin products laboratories at Santa Clara, Calif.

Methacrylate by Escambia

A new process for the manufacture of methacrylic acid and methacrylates by the oxidation of isobutylene with nitric acid has been invented and developed by Escambia Chemical Corp. A large scale pilot plant is being designed to train operators, provide customer samples for commercial development, and to provide data to insure the most economical sizing of some manufacturing components.

The company is working with several foreign chemical manufacturers to develop **(To page 208)**

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propylene oxide and acrylonitrile programs started in Escambia research. These foreign firms are in the process of additional pilot plant work, which is expected to lead ultimately toward the construction of plants by Escambia and/or its licensees.

Vinyl copolymer latex

Development of a new vinyl copolymer latex having exceptional heat and light stability has been announced by The Dow Chemical Co.

Designated Experimental Latex X-2726, the material is designed to be of use in many textile coating applications.

According to Dow development chemists, performance tests in specific conventional exposures have shown the heat stability of the new material to be 50% better than the best commercial vinyl chloride type latexes previously available. Exposures of Experimental Latex X-2726 in an Atlas Fadeometer have shown improved light stability by a 20 to 30% margin.

In addition, the new latex is reported by Dow to have broad compatibility with plasticizers and other film forming latexes, and may be fused at lower heat than competitive unplasticized latexes.

Stabilizer properties

Let no one ever again say that a brief, understandable piece of literature on the function and use of stabilizers for vinyl chloride is not available. Norman L. Perry and Dr. Arthur Hecker of Argus Chemical Corp. have prepared a 16-page brochure on this subject that is truly informative, although it is of course based primarily on their own products. The brochure is based on an outdoor light stability study made over a 24-month period at the testing site of Desert Sunshine Exposure Tests in Phoenix, Arizona. The tests primarily investigated the effect of components of barium-cadmium stabilizer systems on outdoor aging of vinyls. In addition to stabilizers, the study also reports on the role of resin, plasticizer, opacifiers and auxiliary light stabilizers in vinyl compounds. The booklet can be obtained upon request from Argus Chemical Corp., 633 Court St., Brooklyn 31, N. Y.

The tests are particularly important for the formulation of compounds to be used in such outdoor products as swimming pools, beach toys, coverings used on the farm, camping and garden equipment.

A few excerpts are paraphrased as follows:

The effect of an epoxy plasticizer in extending heat stability has long been known, but its beneficial effect in tripling or quadrupling light stability, when used with barium-cadmium is apparent from the tests.

A compound stabilized only with epoxy showed poor weathering resistance but when used with complete barium-cadmium system, the full light stabilizing action of the epoxy plasticizer was realized.

Comparison of several compounds indicated only slight improvement in light stability as a result of doubling the concentration of metallic stabilizer. Similar comparison indicated a relatively minor fall-off in light stability as the epoxy content was decreased from five parts to one part. But these compounds, regardless of amount of epoxy plasticizer and barium-cadmium stabilizer, had approximately the same usable exposure life (18 months).

It can be concluded that stabilizer content is relatively unimportant in the attainment of optimum light stability. However, it is important that a combination of a barium-cadmium-phosphite system and an epoxy be employed.

The best guide for formulating a compound to give optimum weatherability is to include a barium-cadmium stabilizer system in combination with an epoxy plasticizer, in the amount necessary to give the degree of heat stability required for processing.

Pronounced further improvement in light stability can be obtained through incorporation of 0.1 to 0.5 phr of benzophenone type light stabilizers.

Lead salts provide good heat stability at low to moderate cost. Vinyls stabilized with lead salts often have a tendency to color shift during processing so their use is generally limited to applications where color control is not necessary. Much vinyl insulation is presently stabilized with lead salts since they provide excellent electrical properties.

All three types of tin stabilizers can provide clarity and freedom from sulfide stain. The prime limitations to their use is high cost.

Many vinyl products, such as draperies and auto upholstery, are subject to light which must pass through glass. A series of compounds exposed under glass indicated no untoward departure from the results obtained by direct exposure for the time needed for breakdown. Exposure behind glass increased the service life of a vinyl compound approximately twofold.

Improved stabilizer for vinyl

An improved barium-cadmium complex stabilizer has been announced by Nuodex Products Co., Div. of Heyden Newport Chemical Corp. Designated Nuostabe V-134, the new product is primarily for use in calendering, plastisol, organosol, extrusion, injection molding, and solution formulations. The primary advantage of V-134 over standard barium-cadmium complex stabilizers is that it imparts superior heat and light stability and sheet color to these compounds at no additional cost, according to the company.

Ferro's new stabilizer

Two new liquid barium-cadmium-zinc stabilizers have been added to Ferro Chemical's extensive line.

While designed primarily for use in unfilled flexible formulations, Ferro 1234 may also be used in filled and pigmented flexibles as well as plastisols. It is claimed to give long-term heat stability and asserted to be superior to earlier stabilizers of the same type, is nonplating, has a low level of sulfur staining, good storage stability, contains no fatty **(To page 210)**

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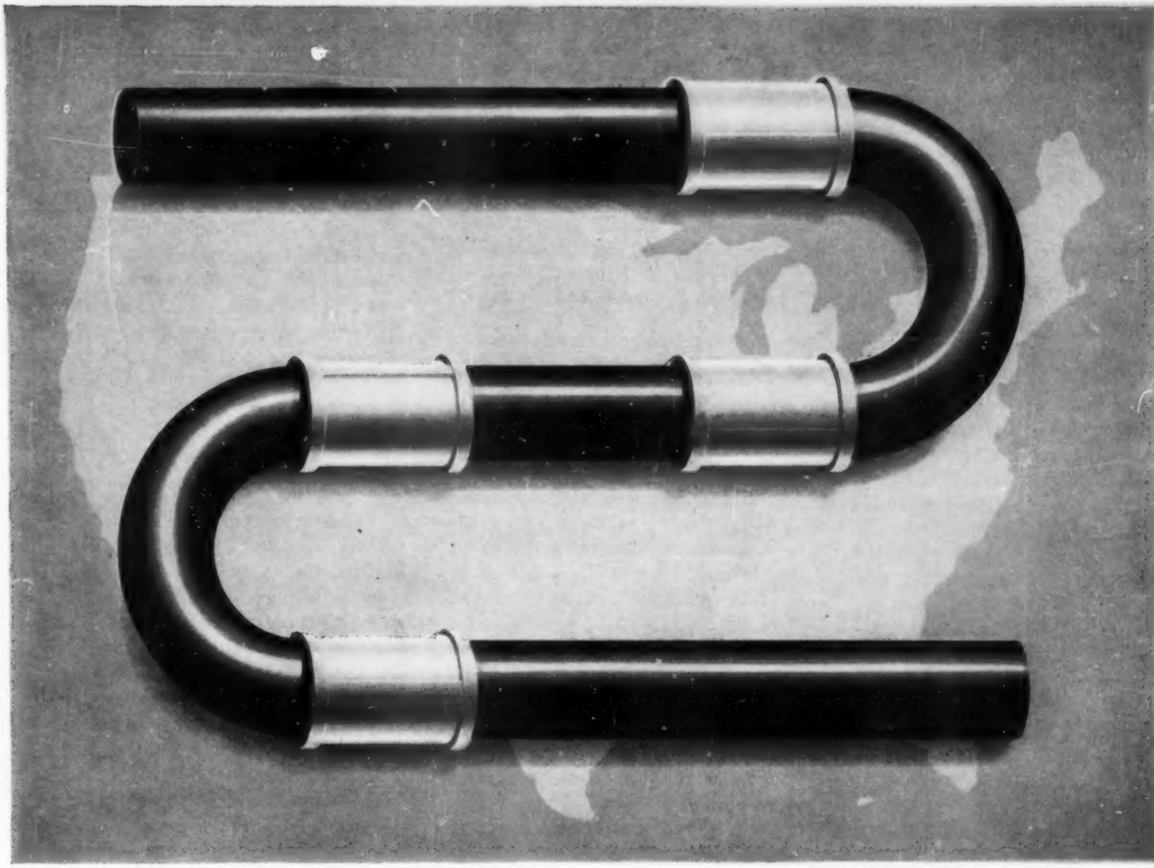

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acids, and requires only ¼ phr of stearic acid for maximum stabilization. It is said to be compatible with all common primary plasticizer systems.

Ferro 1237 is suggested for processing plasticized, filled and pigmented formulations and provides early color retention in white and pastel, as well as darker colors and like Ferro 1234, requires only ¼ phr of stearic acid for maximum stabilization. It gives improved clarity in some formulations or where heat sensitive pigments are used by adding Ferro 904 to the system. The use of 5.0 phr or more of an epoxy plasticizer or 1.0-2.0 phr of an epoxy resin is recommended to enhance its stability.

The price of both stabilizers is 62¢/lb. in 55-gal. drums, 60¢ for 4500 lb., 59¢ in truckloads.

PE light stabilizer

A moderately-priced, effective light stabilizer for polyethylene resins, has been developed and successfully tested by Ferro Chemical, Div. of Ferro Corp., Bedford, Ohio.

Commercially available under the name of Ferro AM 101, the stabilizer is said to extend from two to more than five times the useful life of sunlight-exposed PE products. By the incorporation of Ferro AM 101, PE sheet, film, and fiber remain strong, flexible, and extensible longer under exposure to sunlight than do corresponding products not containing the new material, the company states. Both branched and linear polyethylenes benefit.

Ferro AM 101 is chemically unrelated to conventional ultraviolet light absorbers, and does not function primarily by a UV light absorption mechanism. According to the manufacturer, the cost of Ferro AM 101 may be as low as one-half that of the conventional UV light absorbers. This stabilizer is also reported to be effective for the stabilization of polypropylene. While Ferro AM 101 is available from Ferro Chemical without restriction for use in polyethylene resins, patent rights throughout the world on its use in polypropylene and higher polyolefins are under exclusive license to the Hercules Powder Co.

The optimum use concentration of Ferro AM 101 varies with the source of the polymer and the method and conditions of processing. Frequently, as little as 0.25% is effective, although 0.5% is the level more generally used.

Carbide's epoxy plasticizers

Two new epoxy plasticizers for vinyl resins, Flexol EP-8 and Flexol EPO, are being introduced by Union Carbide Chemicals Co., div. of Union Carbide Corp. Both will be available in commercial quantities this summer from facilities now under construction at Institute, W. Va. They are presently available in experimental quantities.

Flexol EP-8 is 2-ethylhexyl epoxy tallate, and Flexol EPO is an epoxidized soybean oil. Both give excellent long-term compatibility, stabilizing action, and resistance to color development and rancidity in vinyl formulations. Both are effective, low-cost, heat and light stabilizers, as well as plasticizers, for vinyl chloride polymers. They have low volatilities and react synergistically with many metallic stabilizers to increase resistance to heat and light degradation.

Flexol EP-8 can be used as a low temperature plasticizer in place of the more expensive azelate, adipate, and sebacate plasticizers. The viscosity and solvating power of Flexol EP-8 are low, giving low viscosity and excellent viscosity stability to vinyl plastisols. It also reduces the dilatancy problem in the plastisols which are used in high-speed coating operations.

Vinyl film and sheeting containing Flexol EP-8 as the low-temperature plasticizer have good hand and drape. Flexol EPO has excellent resistance to extraction by oil and water when used to plasticize vinyl chloride polymers. Maximum compatibility and stabilization are assured because of its high oxirane oxygen content and low residual unsaturation.

Reactive polyepoxides

A new series of high purity epoxidized fatty esters will be introduced by Swift & Co.'s Technical Products Dept., Hammond, Ind. These new epoxides are produced by a process allowing up to 96% conversion of unsaturated fatty esters to epoxides.

Epoxol 7-4, made from soybean oil, is the first of these products and marks Swift's entry into the plastics field. The new process by which it is produced minimizes the formation of hydroxylated and polymeric by-products, and it is claimed that Epoxol 7-4 is lower in viscosity and is more compatible with non-polar resins.

Polymeric plasticizer

A new polymeric plasticizer, Admex 770, by Archer-Daniels-Midland Co. is now on the market. It is a primary plasticizer with good low temperature flexibility and excellent resistance to extraction and migration. It is light in color with a low odor level, does not crystallize or form a precipitate when exposed as a liquid to low temperatures.

The new material is recommended for use in organosol cloth coatings and in calendered film and sheeting suitable for electrical tape and upholstery applications. Low migration into adhesive masses makes it ideal for vinyl-metal laminates and pressure sensitive tape. Styrene craze resistance and low odor point to the plasticizer's use in new refrigerator gasket compounds. Admex 770 performance is said to be far in excess of UL minimums, making it suitable for 105° C. wire coating applications.

Plastics for tooling

The Research Fund of the American Society of Tool Engineers (ASTE) is again sponsoring studies on plastics for tooling to be undertaken at Purdue University. Six reports have already resulted from previous sponsorship, and the additional funds will be used to carry out an extension of the study of shrinkage tests; a study of im- **(To page 212)**

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pact tests; an initiation of the study of abrasion tests; and an extension of the bibliography. It is anticipated that the cost of these studies will amount to at least $15,000.

John Mickey, Ford Motor Co., is chairman of the steering committee of the ASTE Plastics for Tooling project.

Unplasticized vinyl in Europe

It is well known that unplasticized vinyl chloride film is much more widely used in Europe than in the United States. How it is being used is discussed in a treatise on their Vynan film by La Cellophane, S.A., 110 Boulevard Houssman, Paris 8, France.

This company's particular brand is a calendered film available in roll form in widths up to 57 in. and in thicknesses ranging from 0.0016 to 0.008 inches and should soon be available in thicknesses up to 0.012 inches. Its s.g. is 1.38, wvt is fairly low and gas permeability is halfway between that of regenerated cellulose and polyethylene. It can withstand continuous exposure to temperatures up to 158° F. which would permit pasteurizing. Cold resistance without embrittlement is 14° F. Company officials assert it has been acknowledged as non-toxic by the French counterpart of the U. S. Food & Drug Administration and thus could be used for certain foodstuffs.

Vynan can be vacuum formed with comparative ease, according to company literature, and is said to be currently used in Europe for packaging pickles, mustard, fish fillets, shelled nuts, and is suggested for such things as jam, fresh cheese, spices, powdered sugar, pharmaceuticals, haberdashery, and hardware. The French assert that Vynan is less costly than acetate or butyrate; there is no danger of plasticizer migration; has higher thermal resistance than unplasticized vinyl copolymers; has a much lower thermoforming cycle than PE; has higher impact strength than a styrene copolymer; and has several advantages over cardboard, glass, and metal.

The company claims its unplasticized film is superior to aluminum or tin for metal cap lining for bottles containing mineral water, fruit juices and other beverages or chemicals, to a vinyl dispersion coating which is often too thin, and to a solution coating where costs are higher.

As an adhesive tape Vynan has great mechanical strength, moisture resistance and dimensional stability. As a sound recording tape its dimensional stability helps prevent sound distortion and its elasticity withstands impact when the tape starts unwinding.

Flexible sound records made with a combination of Vynan and cardboard can be very low cost but in this case the film must be plasticized. The unplasticized film is a good electrical insulator in the lower and middle frequency range, but is not satisfactory for high frequency and cannot be used where con- **(To page 214)**

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tinuous temperatures exceed 158 to 176° F. However there are many applications where its mechanical strength, thermal resistance, and often lower cost are desirable.

Another interesting use is as a backing material for tire retreading on which the rubber is "cast" and then wound up with the vinyl acting as an interleaving sheet.

Unplasticized vinyl laminates with paper gives moistureproofness and heat sealability. When applied to aluminum, it improves the latter's mechanical strength, eliminates pinholes, and makes possible the use of a lighter aluminum gage. It is suggested particularly for use in moisture-proofing roofs. With polyurethane foam, it makes a laminate for window liners for moisture-proofing and thermal insulation.

New Engineering Editor

George R. Smoluk has been appointed Engineering Editor of MODERN PLASTICS *Magazine* and the MODERN PLASTICS *Encyclopedia Issue*. Mr. Smoluk holds an M.S. degree in plastics engineering from Princeton University, was an application engineer in the Plastics Department of General Electric Co., a field service engineer for Du Pont, a new product engineer with Union Carbide Plastics, and a chemical engineer with Celanese Corporation. He is thoroughly experienced in all phases of process engineering and design.

Smoluk

Dr. James F. Carley has resigned as Engineering Editor to become an Associate Professor at the University of Arizona. His talents remain available to our readers as Engineering Consultant.

Vacuum metallizing for autos

Vacuum metallized plastics, cheaper than chrome plated metal, will be found in a limited way on some 1960 cars, and are scheduled for widespread use on the 1961 models. Metallizing opens the way to substitution of plastics for metal

wherever the latter's strength is not required and thus makes possible a savings in cost and weight, according to National Research Corp., a producer of vacuum metallizing equipment.

Metallized parts for cars where it is a "second surface" or coating on the back of a clear plastic molding are now several years old. But according to NRC, new improvements in lacquers, rotary gas ballast pumps, improved high vacuum pumps, refrigerated cold traps are among the improvements that make it possible to metallize on the first surface and produce parts that will stand up under the wear normally encountered in automobile interiors.

A more recent development has been introduced that will permit vacuum metallizing to be utilized for outside surfaces, if not on 1960 models, at least in future years, according to NRC. A special thick film process developed by NRC makes it possible to apply relatively thick films of metal to steel or other metal parts. This coating is bright and permits anodizing or coloring without the mottled effect of cast aluminum.

However, in the 1960 models, the principal automotive uses will be for interior trim, horn buttons, dials and instruments, arm rests, and dome lights.

Another new use for vacuum metallizing pointed out at the TAPPI meeting by K. C. Taylor of F. J. Stokes Corp., another equipment producer, is vacuum coated vinyl film as an improved form of Christmas tree tinsel. It will be fire-resistant, easier to handle than foil tinsel, and easily pulled out of a bundle one strand at a time. Another use of vacuum coated film has been for large superstructure balloon bags, which are metallized in order to reflect intensified sunlight and thus cool the bags.

Epoxies

Catalyst prices down. Heyden Newport Chemical Corp. reduced price schedules on Beta-S, a liquid decarboxylic acid anhydride introduced earlier this year as an epoxy resin catalyst and chemical intermediate. The new price of Beta-S in 55- **(To page 218)**

NATCO

INJECTION MOLDING MACHINES

DEPENDABLE... FAST CYCLE...

The Natco Injection Molding Machines are proven performers and are well known as "The Molders Molding Machine." Each new installation has shown amazing production performance. The Natco "patented" closed-circuit shockless hydraulic system, fast injection rate, high speed clamp action, two-speed injection control, automatic dual voltage heating, big capacity "leakproof" heating chamber and a choice of 20,000 or 30,000 psi interchangeable plungers makes Natco the first choice of molders who want the best. These features plus unequaled dependability designed into the Natco is the answer to better profits in today's competitive injection molding market.

ASK THESE MOLDERS WHAT THEY LIKE ABOUT THEIR NATCOS

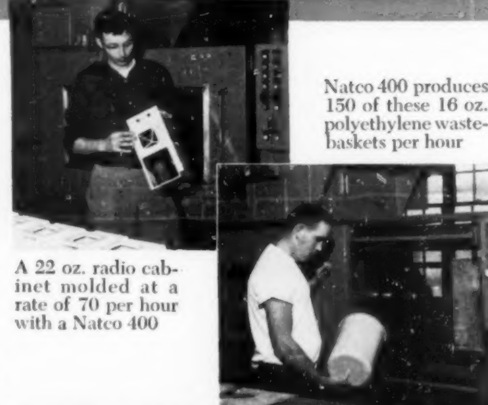
• Alladin • American Plasticraft • Blisscraft • Bluebird • Brittian • Buffalo Molded • Champion Molded • Commonwealth • Dryden Rubber • Evans Zier • Federal Enameling & Stamping • Fischer • General Die Mold • General American Transportation • Gerber • Guide Lamp • Kinder • Kusan • Lakeland • Lee Deane • Market Maid • Midwest • Missouri Wood Heel • Modern Plastics • Napco • N.F.C. Engineering • Pride • Research • Stylette • Tri-State • Victory Button • Vulcanized Rubber • Western Electric

HEELS TO TILE

Molding 8 polystyrene wall tile on a 13 second cycle with a Natco 300

Natco 300 molds ladies shoe heels in 12 cavity mold . . . a 22 oz. shot

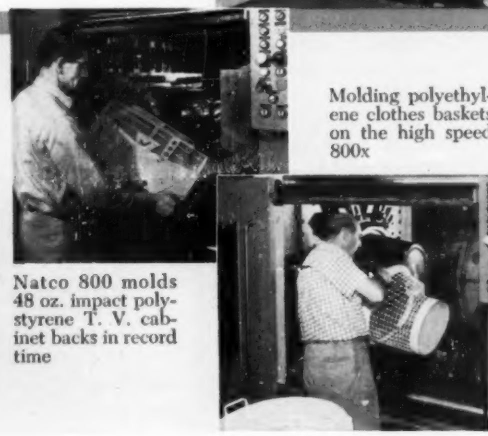
RADIOS TO BASKETS



Natco 400 produces 150 of these 16 oz. polyethylene waste-baskets per hour

A 22 oz. radio cabinet molded at a rate of 70 per hour with a Natco 400

T. V. TO HOUSEWARES



Molding polyethylene clothes baskets on the high speed 800x

Natco 800 molds 48 oz. impact polystyrene T. V. cabinet backs in record time

WRITE FOR CATALOG 2001

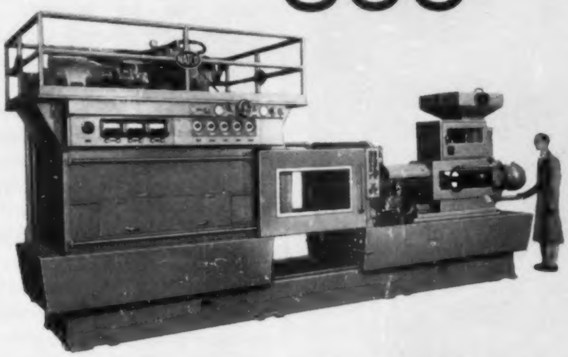
BRANCH SALES OFFICES IN . . . Buffalo, N. Y. . . . Berea, Ohio . . . Devon, Pa. . . . Mt. Vernon, N. Y. . . .

DISTRIBUTORS

CHICAGO	DETROIT	ST. LOUIS	LOS ANGELES	NEW ENGLAND	PITTSBURGH
Four States Mchry 5300 W. Chicago ES 9-3200	Peninsular Mchry 19178 James Couzens DI 1-0880	Moehlenpah Eng. 1315 S. Vandeventer JE 3-0325	Ellison Mchry 160 W. 33rd RI 9-5461	McIntyre Mach. 50 Suffolk St. Worcester, Mass. SW 9-0017	Stanley Berg Mchry P.O. Box 8485 WA 2-3612

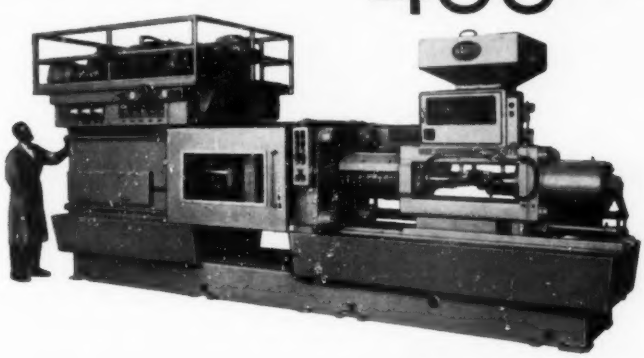
HIGH MELT CAPACITY...
BETTER PHYSICALS...

300



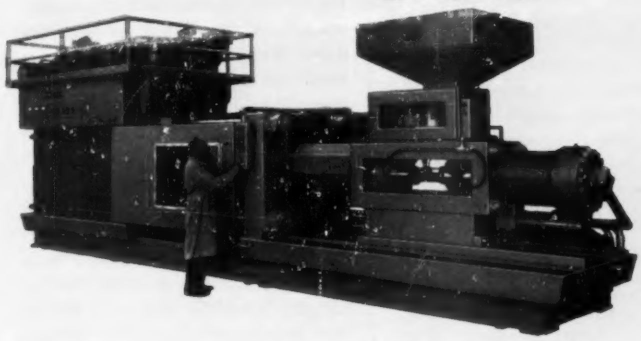
	300
Shot size, ozs.—Single feed	22
Melt Capacity (lbs./hr.)	130
Mold Platens (Inches)	33 x 33
Clearance between Rods (Inches)	21½ x 21½
Clamp Pressure (Tons)	325
Clamp Stroke (Max.) (Inches)	24
Daylight Opening (Max.) (Inches)	42½
Injection Speed (Cu. in./min.)	1125

400



	400	400X	400S
Shot size, ozs.—Single feed	28	28	28
Melt Capacity (lbs./hr.)	165	165	165
Mold Platens (Inches)	38 x 38	38 x 38	38 x 41
Clearance between Rods (Inches)	25 x 25	25 x 25	22 x 25
Clamp Pressure (Tons)	425	425	550
Clamp Stroke (Max.) (Inches)	26	26	26
Daylight Opening (Max.) (Inches)	50	50	48
Injection Speed (Cu. in./min.)	1140	2420	1140

800



	800	800X
Shot size, ozs.—Single feed	80	80
Melt Capacity (lbs./hr.)	350	350
Mold Platens (Inches)	55 x 55	55 x 55
Clearance between Rods (Inches)	36½ x 36½	36½ x 36½
Clamp Pressure (Tons)	850	850
Clamp Stroke (Max.) (Inches)	40 or 55	40 or 55
Daylight Opening (Max.) (Inches)	85	85
Injection Speed (Cu. in./min.)	2000	4000

NATCO

THE MOLDER'S MOLDING MACHINE

NATIONAL AUTOMATIC TOOL COMPANY, INC.
PLASTIC MACHINERY DIVISION
RICHMOND, INDIANA, U. S. A.

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gal. drum truckloads is 75¢/lb., 76½¢/lb. in 5000-lb. lots, and 80¢/lb. for under 5000-lb. orders. Prices for 15-gal. drum sizes are 77¢, 79¢ and 83¢/lb. for similar quantities. Previous schedule for Beta-S was $1.00/lb. for all levels.

Used on jet bomber. Aerodynamically smooth surfaces required on the supersonic USAF B-58 bomber are made with a caulking compound based on Bakelite epoxy resins, according to the aircraft manufacturer, Convair Div. of General Dynamics Corp., Fort Worth, Texas.

The B-58 Hustler is designed to operate at altitudes over 50,000 feet. Caulking formulations passed rigid high-temperature tests and resisted swelling of sealing compounds, and also withstand inflight surface friction and temperature with a minimum of cracking.

The Metalset A2 caulking compound—an epoxy formulated with atomized aluminum—is manufactured by Smooth-On Manufacturing Co., Jersey City, N. J., and is applied with an air-operated gun.

Tubing for electrical uses. A new line of epoxy resin-bonded fibrous glass tubing, featuring exceptionally high tensile and bursting strength as well as optimum electrical properties, is announced by National Vulcanized Fibre Co., Wilmington, Del.

Designated Phenolite Grade G-11-3680, or G-11-3681, depending upon its diameter and wall thickness, the tubing is considered ideal as a material for selected electrical or electronic components, such as miniature coil forms and lightning arrestors.

The new Phenolite grade comprises a rolled tube of glass fabric bonded with a high heat-resistant epoxy resin and is available in a range of diameters from ⅛-in. I.D. to 11-in. I.D. with wall thickness from 0.010-in. to 5½ inches.

Aids bonding. Improvements of 40% to 80% in the bonding strength of simple epoxy adhesives are said to have been obtained with Mod-Epox, a new

modifier for epoxy resins produced by Monsanto Chemical Co.

According to the company, the modifier could permit bonding strengths equivalent to present-day adhesives at much lower formulating costs or, perhaps, to obtain new high levels of bonding strength by proper incorporation of Mod-Epox into existing formulations for high-strength adhesives.

For boat industry. Anti-fouling compounds for the laminating of boats are offered by Furane Plastics, Inc., Los Angeles, Calif. Filled with copper salts, these epoxy compounds have been tested for over two years by Furane, demonstrating good resistance to marine growths which attach themselves to organic coatings.

Designated Epocast 1121, the new material also serves as a laminating and coating medium capable of building up complete fibrous glass boat structures.

Patch kit. Easy, economical, and permanent repairs of tools, castings, and heavy machinery are possible with the Hysol epoxy patch kit 6C, developed by Houghton Laboratories, Inc., Olean, N. Y. The kit contains two flexible tubes, one of base resin, the other of hardener. Mixing requires only that an equal length bead be squeezed from each tube. Complete hardening will occur in one to two hours, but can be accelerated by the application of low heat.

Lower cost laminate. A paper base-epoxy resin laminated plastic which is said to combine some of the superior performance characteristics of glass epoxy laminates with the fabrication ease of paper phenolic laminates, has been developed by Taylor Fibre Co., Norristown, Pa. It is lower in cost than glass base-epoxy laminates.

Designated as Grade XY-1, the new laminated plastic is furnished in 37-in. by 49-in. sheets from $\frac{1}{32}$- to $\frac{1}{4}$-in. thick. It is also available in copper-clad form (Grade XY-1 Cu-Clad).

The copper-clad grade is expected to find wide use in computor applications where a high degree of reliability is required and reasonably low cost is desirable in the printed circuitry.

Grade XY-1 laminated plastic has flexural strength and insulation and moisture resistance approaching that of glass epoxy laminates, yet it retains the ease of machining and punching characteristic of paper phenolic laminates. It also retains the excellent chemical resistance of epoxy materials and has low dielectric loss, the company states. It is a self-extinguishing laminate according to UL tentative test methods.

New companies

Extron Corp., 3600 Pleasant Ridge Rd., Knoxville, Tenn., was formed to extrude rigid plastics shapes. **M. S. Pfeifer** is prod. mgr. and **E. O. Redwine** heads sales.

Steven Enterprises, 10 Broadway, Unit 4, Millbrae, Calif., is a new company that offers technical development and marketing of machinery and products related to plastics and packaging. The company will sell equipment and materials for polyethylene film packaging. Steven also acts as rep. for **Doven Div.** of **Appleton Machine Co.,** Appleton, Wis. **Ned L. Roberts** resigned as pres. of **Ned L. Roberts, Inc.** to head Steven Enterprises.

Resin Consultants and Mfg. Co., Inc., 132 Nassau St., New York 38, N. Y., is offering custom packaging and formulating of epoxy resins for adhesives, impregnating, potting, and casting formulations in all weight ranges.

Expansion

Reichhold Chemicals, Inc. plans to build a multi-million dollar melamine plant in the South, at a site that has not yet been announced. Initial capacity of the plant will be 20 million lb. annually, but it will be designed for eventual expansion to 50 million lb. annually. According to **Henry H. Reichhold,** president, the new facility will make RCI the second major supplier of melamine in the United States. The proceeds of the issue of **(To page 220)**

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400,000 shares of new common stock have provided the funds, Mr. Reichhold stated, and this plant is only one step in the $24 million three-year expansion program upon which the company embarked in 1958.

RCI will also construct a $4 million maleic anhydride plant at Elizabeth, N. J., adjacent to existing facilities. Capacity of the new plant will be 20 million lb. per year.

The company purchased a 70-acre tract at Newark, Ohio, which will be the site of Reichhold's eighteenth domestic plant. Production of a full line of resins and chemicals is contemplated for the plant.

Resinas Venezolanas C. A. is a new company formed by Reichhold and a group of Venezuelan industrialists to produce synthetic resins in Caracas, Venezuela.

American Cyanamid Co. will build a new facility to produce melamine crystal adjacent to the company's existing molding compound plant and development laboratory at Wallingford, Conn.

The plant will have an initial capacity of 10 million lb. of melamine annually, and will utilize an improved process. It is expected to be in operation early in 1960.

This new unit is the first in a planned expansion program and will supplement the existing melamine manufacturing unit at Willow Island, W. Va.

New Rochelle Coating Corp. designed and installed a new pressure-sensitive coating machine in its plant at New Rochelle, N. Y. The machine is capable of handling a web of material over 5 ft. wide, and is capable of processing volume quantities of vinyl, Mylar, urethane foam, as well as films and foils. The company is a custom fabricator, specializing in formulating special coatings, and designing and producing coated products on a custom basis.

B & E Electroform Co. moved into its new 2000-sq.-ft. plant on Greely Ave., Union, N. J. The company specializes in electroforming nickel as a replacement on damaged molds and tools, and fabricates solid cavities. B & E has done extensive research and development work in these fields, exclusively for the plastics industry.

Comco Plastics, Inc., fabricating facility of **Commercial Plastics & Supply Corp.,** moved to new quarters at 98-34 Jamaica Ave., Richmond Hill, Long Island, N. Y. The new plant and facilities are four times larger than the previous location.

The company is a custom precision fabricator of phenolic laminates, nylon, Teflon, methacrylate, and other plastics used for insulation and mechanical applications.

Lusteroid Container Co., Inc., Maplewood, N. J., installed new equipment and is now able to supply extrusion or injection molded cylindrical containers made from polypropylene, cellulose acetate, and cellulose acetate butyrate.

The company also injection molds polypropylene specimen containers for life insurance companies, and supplies other plastics containers.

Durez Plastics Div. of **Hooker Chemical Corp.** is installing equipment to expand the production of formalin at North Tonawanda, N. Y. Additional production will become available in stages and, upon completion at the end of the year, should provide an approximate 10% increase in formalin capacity with no increase in manpower.

Manufacturing facilities for wood flour, used as a filler for molding compounds, are being expanded at the Durez Plastics Div.'s Kenton, Ohio plant.

Kenton will manufacture glass-filled phenolic molding compounds, such as Durez 16771, about the end of the year, when equipment will have been installed in a new building to be erected for that purpose.

Union Carbide Canada Ltd., Carbide Chemicals Co., is expanding the polyethylene production capacity of its Montreal East plant 60 percent. This is **(To page 222)**

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part of a continuous expansion program which has taken place since the plant went on stream in May 1957. The augmented facilities, scheduled for completion early in 1960, will provide the Montreal plant with an annual PE capacity of over 65 million pounds.

Columbian Carbon Co. will build a $6 million plant near Milan, Italy, with production facilities for over 60 million lb. of carbon black annually to supply the European Common Market area.

The new facility is expected to be in full operation by early 1961. It will operate under the company name of **Columbian Carbon Europa.**

Continental-Diamond Fibre Corp., a subsidiary of **The Budd Co.,** opened a new integrated warehouse, sales and engineering headquarters for serving the Southern Calif. area in the building of **Wheel Industries, Inc.,** 2600 Santa Fe Ave., Los Angeles, Calif. CDF products were formerly warehoused by **Marwood, Ltd.,** Los Angeles, for the Southern Calif. area.

Supervisor of the expanded warehousing and sales-service departments will be **Edgar Davis. George Shima,** CDF sales engineer, is in charge of application design problems.

Foster Grant Co., Inc. has broken ground for the first section of its new $1 million research center at Leominster, Mass.

The new laboratory building will increase the company's research and development facilities by 50 percent. The first section is scheduled for completion in approximately four months.

Hardesty Research and Development moved to a new plant at 3015 Kilson Dr., Santa Ana, Calif. The missile components firm, formerly of Los Angeles, Calif., designs, develops, and fabricates filament-wound plastic structures, including rocket cases and pressure vessels; and also makes ablative coatings for rocket nozzles and re-entry nose cones.

Dow Badische Chemical Co. plans to produce acrylic acid and methyl, ethyl, butyl and other acrylic esters at a plant under construction near Freeport, Texas, adjacent to **Dow Chemical Co.'s Texas Div.** facilities.

Production is expected to begin next January, following completion of the plant in December.

The company, capitalized at $6 million, is owned jointly by Dow and **BASF Overzee, N. V.,** a subsidiary of **Badische Anilin-& Soda-Fabrik A.G.,** Ludwigshafen, Germany.

It is expected that the technical grade of acrylic acid will be sold for use as an intermediate in the production of higher acrylic esters, normally not available on the commercial market.

Other markets for acrylic acid and the esters will be plastics and resins; paint manufacturing, particularly in outdoor type latex paints; synthetic fibers; leather; textile and paper finishing; and rubber manufacture.

Houghton Laboratories, Inc., Olean, N. Y., has completed a new raw materials warehouse containing 4300 sq. ft., complete with new truck loading docks and railroad siding.

W. R. Grace & Co. is constructing a $2 million addition to its existing Cryovac plant at Simpsonville, S. C. Completion of this second major expansion since the plant was built four years ago is scheduled for 1961.

Whitehouse Boat Co., Fort Worth, Texas, manufacturer of fibrous glass boats, has purchased **North American Mfg. Corp.,** Warsaw, Ind., manufacturer of small boats in fibrous glass, aluminum, and wood.

The Indiana company will be a wholly owned subsidiary of Whitehouse. **Ben Whitehouse, Jr.,** pres. of Whitehouse Boat Co., expects production of 30,000 units in 1960, with this new plant. The two boat com- **(To page 224)**

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panies, together with **Whitehouse Chemical Co.**, which manufactures polyesters, had sales of $6 million through the past seven months, and expect sales of $20 million in 1960.

Leonard Kunz of Fort Worth will be VP and gen. mgr. of the Warsaw plant.

Walbro Corp., Cass City, Mich., designer and manufacturer of small engine carburetors and electric fuel pumps, has acquired **Arjay Mfg. Co.**, Vassar, Mich., a plastics injection molding company. **W. B. Hoey** becomes exec. VP and gen. mgr. of Arjay, and **Ralph E. Jones** will be chief engineer.

A. E. Staley Mfg. Co., Decatur, Ill., corn and soybean processor, is entering the synthetic polymer field. A polymer pilot plant in Decatur is now in semi-works production of acrylic type emulsions. The company's research developments in synthetic polymers are centered on resin emulsions for industrial uses.

Staley also announced plans to acquire **UBS Chemical Corp.**, Cambridge, Mass.

Chas. Pfizer & Co., Inc. has broken ground for its World Headquarters Bldg. The 32-story structure, scheduled for completion in the spring of 1961, will rise at 235 E. 42nd St., New York, N. Y.

Ciba Products Corp. is building a new plant at Toms River, N. J., to produce epichlorohydrin, the basic raw material used in the production of epoxy resins.

The output of the new plant will be used solely for the company's manufacturing operations. Completion is scheduled for 1960.

National Starch & Chemical Corp. has purchased **Polimeros S. A.**, a manufacturer of vinyl acetate polymers, located in Mexico City, Mexico. **Donald E. Reese**, founder of Polimeros will continue as pres. of the Mexican company, which will operate as a wholly owned subsidiary.

Resin Research Laboratories, Inc., Newark, N. J., established a new technical service department to provide a fully-equipped laboratory with complete staff for technical service applications.

C. A. Litzler Co., Inc., Cleveland, Ohio, designers of plastics coating production lines and other processing units, have acquired the **Ovens for Industry Div.** of **Ryan Industries, Inc.**, also of Cleveland, to broaden its line of continuous processing equipment involving heat transfer to cure and treat plastics, coated metals, and synthetic filament webs. **Dwight M. Wilkinson**, founder of Ovens for Industry and exec. VP of Ryan, joined Litzler as VP in charge of sales.

Blackman Plastics constructed a new 10,000-sq.-ft. plant in Escondido, Calif., to house the com-

pany's Toy & Hobby Div. The Industrial Products Div. remains in Los Angeles, Calif. and will use the entire facility there to produce formed plastics products for the aviation, industrial, and institutional fields.

George Beck, VP and sales mgr., and **Henri Castaing,** prod. mgr., head the Escondido operation.

The Gilbert Mfg. Co., Inc., 24-20 46th St., Long Island City, N. Y., custom molder, will have over 70,000 sq. ft. of productive capacity when its program of plant expansion is completed in the near future.

Plastic Materials & Polymers, Inc. (P.M.I.), Hicksville, N. Y., has broken ground for a second plant to be located at the Woonsocket Industrial Park, Slatersville, R. I.

The 26,500-sq.-ft. facility, scheduled for completion in September, was designed for the production and development of thermoplastic molding and extrusion materials, and will employ about 60 persons. It will operate as a separate subsidiary of P.M.I. under the corporate name of **Eastern Plastic Materials, Inc.**

Tommy Tucker Plastics has almost doubled production and office facilities with a new 20,000-sq.-ft. plant at 3411 E. Kiest Blvd., Dallas, Texas.

The company is adding a line of injection-molded boxes to expand its plastics packaging division. An automatic sheeting machine for converting rolls of plastics materials into sheets is being installed, and the company will offer custom fabrication of polyethylene film for industrial covers.

Meetings

Plastics groups

Sept. 10, 11: The Society of the Plastics Industry, Inc., Midwest Section Conference, French Lick-Sheraton Hotel, French Lick, Ind.

Oct. 1, 2: The Society of the Plastics Industry, 15th New England Section Conference, Wentworth-by-the-Sea, Portsmouth, N. H.

Oct. 7: Society of Plastics Engineers, Cleveland Section, RETEC, Cleveland Engineering Society, 3100 Chester Ave., Cleveland, Ohio.

Oct. 13, 14: Society of Plastics Engineers, Southern California Section, NATEC. "Plastics Engineering—State of the Art Today." Ambassador Hotel, Los Angeles, Calif.

Oct. 17-25: "Kunststoffe 1959," International Fair of the Plastics Industry, Düsseldorf, Western Germany. Also concurrent technical sessions.

Other meetings

Sept. 21-23: Technical Association of the Pulp & Paper Industry, 14th TAPPI Paper-Plastics Conference, Edgewater Beach Hotel, Chicago, Ill.

Oct. 7-9: American Vacuum Society, 1959 National Symposium on Vacuum Technology, Sheraton Hotel, Philadelphia, Pa.—**End**

COMPANIES . . . PEOPLE

Appointments, promotions, and relocations in the plastics industry.

Monsanto Chemical Co.: Charles H. Sommer, previously VP and gen. mgr. of the Organic Chemicals Div., named exec. VP of the company. He is succeeded by **Robert M. Morris**, former asst. gen. mgr. of the div.

Plastics Div.: W. Robb Nisbet, formerly mfg. supt. of the Lion Oil Co. ethylene facilities, promoted to asst. plant mgr. of the Texas City, Texas, Plastics Div. plant. Also at Texas City, **Dr. Y. K. Pan** and **James C. Burleson** joined the research dept. **Robert K. Todd, Jr.**, **Byron L. Johnson, Jr.**, **J. Leroy Schlechte**, and **James S. Piker** joined the mfg. dept. **Alvin E. Harkins, Jr.** and **Thomas J. Manning** now with the engineering dept. **Norwood J. Ruiz** and **Robbert M. Stewart** joined the maintenance dept.

At the Springfield, Mass. facility, **Richard P. Bishop** joined the engineering dept. **Philip F. Casey**, **Harvey J. Deright**, **Donald E. Stamp**, and **Fred H. Beaumont, Jr.** are new members of the sales dept. **Stephen W. Dunn**, **John M. Conley**, and **Michael J. Nash** joined the prod. dept. **Normand E. Plante** and **Anthony Lagani, Jr.** now with the research dept.

E. M. Jones, previously mfg. supt. in charge of Texas City's styrene and vinyl chloride units, promoted to plant mgr. of the Addyston, Ohio plant. **George W. Fleming** joined the laboratory dept. at Addyston.

Organic Chemicals Div.: Arthur P. Kroeger promoted from dir. of marketing to asst. gen. mgr. He is succeeded by **Herbert S. Parham**, formerly dir. of sales planning.

Overseas Div.: William T. Dickens, formerly asst. to the Plastics Div.'s dir. of sales at Springfield, named to newly-created post of dir.—mfg.

Allied Chemical Corp.: Kerby H. Fisk, chrmn. of the board, also becomes chief exec. officer. **Harry S. Ferguson**, exec. VP, becomes chief admin. officer, and **Chester M. Brown**, pres. of **National Aniline Div.**, named pres. and chief operating officer, effective upon retirement in September of **Glen B. Miller**, pres.

National Aniline Div.: Charles P. Berdell, formerly mgr. of sales for Baker & Adamson products with the company's **General Chemical Div.**, appointed dir.—chemical sales. He succeeds **Dr. Oliver M. Morgan**, who was named asst. to the exec. VP of **Allied Chemical Canada, Ltd.**

Union Carbide Corp.—Union Carbide Chemicals Co.: The following are new assignments in the sales dept.: **Dale F. Swartz** from Buffalo, N. Y. dist. mgr. to St. Louis, Mo., dist. mgr.; **Robert W. Lindberg** from Cleveland, Ohio asst. dist. mgr. to Buffalo dist. mgr.; **John W. Fleck** from tech. rep. to Cleveland asst. dist. mgr.; and **Paul G. Horecka** from tech. rep. to New York, N. Y. asst. dist. mgr.

The following tech. reps. have been transferred: **Anthony P. Chavent** from Cincinnati, Ohio to Boston, Mass.; **Robert W. Halley** from Los Angeles, Calif. to Cleveland; **John T. Kuzara** from New York to Los Angeles; and **Francis N. Wright** from Newark, N. J. to Charlotte, N. C.

Lawrence J. Bartal, **Arthur M. Chagares**, and **Joseph R. Franke** named tech. rep. at Los Angeles, New York, and Cincinnati districts, respectively.

Dr. George G. Madgwick joined the development dept.

Union Carbide Plastics Co. opened a sales office in the Fidelity Union Life Bldg., 1511 Bryan St., Dallas 1, Texas. **James Gibbons** is tech. rep. and will handle sales of all the company's plastics products.

Visking Co.: William L. Ketner promoted from personnel administrator of the Plastics Div. to mgr.—industrial relations for the company.

Union Carbide Canada Ltd., Carbide Chemicals Co.: H. L. Reichart, Jr. promoted from VP—prod. & engineering to VP and gen. mgr.

The Dow Chemical Co.: Walter P. Creamer named to head plastics sales in the Boston, Mass. office territory. He succeeds **Richard W. Beckwith**, who moves to the Washington, D. C. office in a plastics liaison capacity.

Dow Chemical International Ltd. S.A.: Max Key, formerly plastics prod. mgr. of the **Dow Midland (Mich.) Div.**, appointed operations VP. **A. M. Griswold**, VP, and **E. K. Stilbert**, mgr.—coatings materials, Dow plastics dept., named product group VPs.

The Dobeckmun Co.: Austin E. Dawson, supt. of the Brookside plant, appointed plant supt. of the new Findlay, Ohio polyethylene plant. **John Moss**, formerly chem. engineer in charge of the PE bag dept., named tech. dir. at Findlay.

General Motors Corp.: Dr Philip Weiss heads the newly-created Polymers Dept.

Maurice D. Cooper named head of the Chemistry Dept., in succession to **Ralph J. Wirshing**, who retired.

Heyden Newport Chemical Corp.—American Plastics Corp.: John A. Parsons, VP in charge of production, named exec. VP.; **J. William Arpin** promoted from asst. plant mgr. to VP—engineering and development; and **Elmer G. Smith**, previously sales mgr., elected a VP of the subsidiary.

Chemical Div.: David X. Klein appointed tech. dir.

Society of Plastics Engineers, Inc.—Detroit Section: Gerald D. Gilmore, Bopp-Decker Plastics; Frank S. Marra, Detroit Mold Engineering Co.; and **Ernest F. Widlund, Du Pont**, elected dirs.

Gordon B. Thayer, The Dow Chemical Co., elected pres. for the coming year.

American Cyanamid Co.—Formica Corp.: William F. Drees named a VP, responsible for the company's research and planning activities. **Charles G. Reiter**, former mgr. of the North Central region, succeeds Mr. Drees as flakeboard and special products mgr.

B. R. Allen is now North Central region mgr. and **Mark E. Bloch** succeeds Mr. Allen as mgr. of the Chicago, Ill., sales office.

Thomas W. Mason named mgr. of the Cleveland, Ohio dist. office, succeeding **Wm. O. Miller**, who died.

Organic Chemicals Div.: R. E. Leach appointed mgr. of the Marietta, Ohio plant, and **A. C. Fennimore** named mgr. of the Willow Island, W. Va. plant. **J. W. Dykes**, who has managed both locations for over 10 years, was named mfg. mgt. consultant to the div.

The Dayton Rubber Co., Industrial Products Div.: John Sly named asst. sales mgr. **Joseph B. Maxson** succeeds Mr. Sly as regional mgr.—Central region, with headquarters in Dayton, Ohio.

J. R. South named product mgr.—urethane dept.

Reed-Prentice Div., Package Machinery Corp.: Joseph F. Flavin appointed New England dist. mgr. He will headquarter at the company's main office in East Longmeadow, Mass.

West Marcellus appointed sales rep. in Fla.

Continental-Diamond Fibre Corp., subsidiary of **The Budd Co.: Arthur J. Briggs**, formerly gen. sales mgr., elected VP.

Robert S. Handly named mfg. mgr. of its operations in Newark, Del.; Bridgeport, Pa.; and Valparaiso, Ind. **Edward F. Heffernan, Jr.** appointed Bridgeport, Pa. plant mgr.

Atlas Powder Co. established a development appraisal dept. headed by **James B. Weaver**, formerly mgr. of the economic **(To page 228)**


STAN-TONE COLORS
Provide Stability, Brilliance and Uniformity for Robbins Floor Products, Inc.
Standards have to be high for the materials which go into such quality products as Robbins rubber and vinyl floor tiles.
Robbins tile products require brilliant color which resists fading and harsh cleaning solutions in both home and commercial installations. Good definition of color areas is all-important, and no migration of color is permissible.
That's why Robbins color specialists chose Stan-Tone Dry Colors for their tile. These Stan-Tone colors have exceptional heat and light stability, brilliance, resistance to bleed and migration, and handling qualities.
Robbins Floor Products, Inc. also depends on Harwick for fillers, lubricants, mold releases and various other rubber chemicals.
To get the complete story on Stan-Tone colors, contact your local Harwick technical representative or write requesting technical data to the Harwick main office in Akron.
• STAN-TONE Dry Colors — Organic and Inorganic
• STAN-TONE Paste Colors — In Plasticizer
• STAN-TONE PEC Colors — In Polyester Vehicle
• STAN-TONE GPE Colors — In Ground Polyethylene
• STAN-TONE MBS Colors — Masterbatch of Colored, Plasticized Resin Latex
HARWICK STANDARD CHEMICAL CO.
60 SOUTH SEIBERLING STREET AKRON 5, OHIO
ALBERTVILLE, ALA OLD GUNTERSVILLE HWY • BOSTON 16, MASS 661 BOYLSTON ST • CHICAGO 25, ILLINOIS 2724 W. LAWRENCE AVE • GREENVILLE, S.C. P.O. BOX 746 • LOS ANGELES 21, CALIF. 1248 WHOLESALE STREET • TRENTON 9, N.J. 2595 E. STATE ST

COMPANIES ... PEOPLE

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evaluation section. **Alan G. Bates** is now mgr. of this section. **Frank L. MacArtor** named mgr. of a new long-range forecasting section, and **Stanley Arasim Jr.** is mgr.—marketing research section.

Abbey Chemical Corp., distributor and mfr. of plasticizers, solvents, oils, and organic chemicals, moved its exec. offices from Springfield to Edison, N. J.

The company plans to consolidate its distribution and blending facilities at this location.

Sales offices at Springfield for Abbey and its sales affiliate, **Mercury Chemical Corp.**, will continue to be maintained.

Emerson & Cuming, Inc. established a branch sales office at 52 Elm St., Huntington, N. Y., headed by **Ray L. Johnson.**

AviSun Corp.: Dr. Edward T. Severs named product mgr.—films, and **Edwin M. Irish, Jr.**, product mgr.—polymers. The company will manufacture, process and market polypropylene resins, film, and fibers.

Disogrin Industries, Inc., Mt. Vernon, N. Y., created two sales divs. **Joseph A. Gagen** heads the **Disowheel Div.**, and **Kenneth H. Grim** the **Disogrin Products Div.** The company manufactures urethane elastomers.

The Kendall Co., Polyken Sales Div.: Alfred J. Spiry now responsible for the Polyken sales dept., International Div. of Kendall.

The following were appointed territorial sales reps.: **Donald W. McCabe, James C. O'Brien, Robert L. Toney, Jr., William F. Lechler, M. Lamar Bowden, Joseph F. Batteer, John M. McGivern,** and **James O. Kircher.**

W. J. Flaherty and **Rex Shaw** appointed sales and service supvs., eastern and western, respectively.

Olin Mathieson Chemical Corp., Packaging Div.: Arthur T. Safford named VP—marketing. He succeeds **Walter Hamilton,** who continues as a consultant.

Janet-Geddes Morgan appointed sales promotion asst. for the film operation.

Schwartz Chemical Co. established warehousing facilities at Crooks Terminal Warehouse, Inc., 5817 W. 65th St., Chicago 38, Ill.

American Chemical Corp.: Robert G. Luskin named sales mgr.

The company has under construction new facilities, including gen. offices, at Long Beach, Calif. Production of ethyl chloride, ethylene dichloride and vinyl chloride monomer is scheduled to start at the end of this year. A vinyl chloride polymerization unit is also to be completed early in 1960.

American Chemical is jointly owned by **Richfield Oil Corp.** and **Stauffer Chemical Co.**

U. S. Industrial Chemicals Co., Div. of National Distillers & Chemical Corp.: Warren E. Johnson appointed dir. of chemical sales. **Vincent D. McCarthy**, as dir. of plastics sales, will have responsibility for management of polyethylene sales as well as plastic materials, which the company might produce in the future. **George H. Stanton** assumes position of dir. of field sales, and will supervise the activities of regional sales offices.

Johnson McCarthy Stanton

Taylor Fibre Co.: Carlisle M. Thacker, formerly an engineering consultant with Du Pont, joined as tech. dir.

Donald R. Robertson, dist. sales mgr. for the Western div., moves to New York, N. Y., and **Edward J. Guelpa**, present N. Y. dist. mgr., goes to Calif.

General Mills, Chemical Div.: John Chadwick appointed San Francisco, Calif., sales rep. responsible for sales of Versamid polyamide resins, Genamid epoxy curing agents and other specialty chemical products.

The div. opened a new sales office at 20800 Center Ridge Rd., Cleveland 16, Ohio.

Emery Industries, Inc.; George R. Williams appointed to the development and service dept. Among his initial assignments will be the coordination of all phases of the company's program on the utilization of dimer acid in the production of urethane foams.

Robert H. Endres succeeds Mr. Williams at the New York, N. Y. organic chemical sales office.

The company moved its branch sales office from Lowell, Mass. to 751 Main St., Waltham, Mass. **John A. Condon, Walter R. Paris,** and **Tom W. Macy** will make the new office headquarters for their New England territories.

Carbic-Hoechst Corp. is the new name of **Carbic Color & Chemical Co., Inc.** The corporation will sell pigments, dyestuffs, and textile auxiliaries manufactured by **Farbwerke Hoechst A.G.,** Frankfurt-Hoechst, West Germany; **Hoechst Chemical Corp.,** West Warwick, R. I.; and **Durand & Huguenin S.A.,** Basle, Switzerland.

The headquarters of the Dyestuff Div. will remain at 451 Washington St., New York 13, N. Y., and the Pigment Div. will have headquarters in West Warwick, R. I.

Pro-phy-lac-tic Brush Co.: Paul J. Carroll, purchasing agent, assumed added responsibilities of dir.—materials management, which will include production scheduling and inventory control.

Charles V. Ball named buyer of plastic molds, plastic machinery, and certain raw materials.

Commercial Plastics & Supply Corp.: Carl H. Eiser Jr. named resident salesman for Long Island with headquarters at 597 Everdell Ave., West Islip, N. Y. **Robert Lew** advanced to inside salesman.

Industrial Research Laboratories, Div. of Honolulu Oil Corp.: Edwin A. Brown, formerly mgr. of engineering and production, has been appointed gen. mgr. **Earl R. Rountree** has been named asst. gen. mgr. He will, however, continue to be responsible for sales and customer relations in addition to his new duties.

Rountree

Texas Alkyls, Inc.: A. R. Anderson elected pres.: **Cyril C. Baldwin, Jr.** and **Robert W. Cairns**, VPs.

The company was formed last spring by **Hercules Powder Co.** and **Stauffer Chemical Co.** to manufacture aluminum alkyls near Houston, Texas. These materials are useful as intermediates in preparation of various polymerization catalysts for manufacture of plastics and elastomers. They are currently used in low-pressure PE and polypropylene production.

Anderson Chemical Co. Div. of Stauffer is the sales agent with offices at Weston, Mich.; 380 Madison Ave., New York, N. Y.; and Prudential Plaza, Chicago, Ill.

David W. Towler resigned as a rep. of Minnesota Mining in New England, where he handled the company's Kel-F material. He has returned to the Plastics & Coal Chemicals Div. of **Allied Chemical Corp.,** with whom he had been previously associated.

Dr. John E. Rutzler Jr., assoc. prof. of Physical Chemistry, **Case Institute of Technology,** awarded a $27,150 contract from **Aerojet-General, Inc.** for a project entitled "Strength of Adhesive **(To page 230)**

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Joints." The contract, for a one-year period, is for the investigation of the effects of elevated temperatures on the strength of high polymeric materials for bonding metals.

W. R. Donaldson

W. Richard Donaldson named marketing dir. of the Polymer Chemicals Div. of **W. R. Grace & Co.** He succeeds **Willard de Camp Crater,** who remains as marketing consultant of the division.

Walter G. Andrews, formerly VP and mgr.—resin & plastics div., was elected exec. VP—chemical products group of **Archer-Daniels-Midland Co.** This newly-formed products group includes vinyl plasticizers, resins, and plastics.

Dr. William G. Simeral, sr. supv. in the R & D div. of **Du Pont's** Polychemicals Dept., was transferred from the Experimental Station to the Washington Laboratory at Parkersburg, W. Va. He has been engaged in plastics research for Du Pont since 1953.

Dudley P. Biggs joined **Carl H. Biggs Co.,** Santa Monica, Calif., as mgr. of its new Custom Fabrication Dept.

Harry Myers, tech. sales rep., transferred from Chicago, Ill. dist. office of the **Polyco-Monomer Dept., Borden Chemical Co.** to Dallas, Texas.

W. K. Venatta appointed mgr.—Mfg. Dept., **Oronite Chemical Co.** San Francisco, Calif. He has been manager of the company's Oak Point, La. plant.

Kent Doolittle joined **Kimball Mfg. Corp.,** San Francisco, Calif., as West Coast sales engineer in charge of industrial molding services.

Dr. Peter D. Shroff appointed to the newly-created post of mgr.—product engineering, **Narmco Resins & Coatings Co.,** Costa Mesa, Calif.

Raymond W. Meyer joined **The Glastic Corp.,** Cleveland, Ohio, as tech. asst. to pres. **Roger B. White.**

J. Ed. Rowland named asst. dir. of sales, **Textileather Div., The General Tire & Rubber Co.,** Toledo, Ohio. He has been with the company for 11 years.

Benjamin H. Davis retired from active management participation in **Davis-Standard Corp.** and **The Standard Machinery Corp.,** Mystic, Conn. He will continue as consult-

ant for both companies. Mr. Davis became a VP of Franklin Research Corp. when the two companies merged with Franklin in 1956.

Roland Reppert, formerly VP-sales, named to the newly-created position of VP—marketing of **American Hard Rubber Co.** He will be succeeded by **James P. Coughlin,** previously with Armour-Alliance Corp.

Zeno W. Wicks, Jr., formerly dir.—central research labs., **Interchemical Corp.**, New York, N. Y., appointed mgr. of the company's newly-established commercial development dept. He is succeeded by **Charles S. Rowland.**

Howard Olsen elected VP of **Wess Plastic Molds, Inc.**, New Hyde Park, N. Y. He was formerly owner of **San-Pat Molds**, whose operations are now taken over and will be continued by Wess Plastic Molds, Inc.

Arthur C. Conrad named asst. to the pres. of **Arnkurt Associate Engineers,** designers and engineers of plastics products.

Dr. Elio Passaglia, formerly Physics Section leader, appointed mgr. of the basic research dept., **American Viscose Corp.** He is succeeded by **Dr. Harvey D. Keith.** Dr. Passaglia replaces **Dr. John A. Howsmon,** who was named mgr. of the newly-created Polyolefin Dept.

Louis R. Wanner, formerly in charge of plastics operations, appointed to the newly-created post of chief engineer of the Parts Div., **Sylvania Electric Products, Inc.**

Douglas L. Cochran appointed VP, **National Polymer Products, Inc.,** a subsidiary of **The Polymer Corp.**, Reading, Pa.

Frank S. Bonham appointed tech. dir. of the **Fome-Cor Corp.,** Springfield, Mass.

Arthur N. Heath named mgr. of the **Buildings Trades Div., Furane Plastics Inc.,** Los Angeles, Calif.

Dr. Stephen J. Groszos appointed mgr. of Materials Development Dept. in the R & D Div. of **The Richardson Co.,** Melrose Park, Ill.

Ira Ruhl appointed gen. sales mgr. for **Barclay Mfg. Co., Inc.,** New York, N. Y.

Charles A. Godsell appointed to the newly-created post of eastern regional mgr. for **Shawinigan Resins Corp.,** Springfield, Mass.

John M. Tassie elected pres. and chief exec. officer of **Lenox, Inc.,** Trenton, N. J. Since their acquisition, he has been pres. of the company's subsidiaries, **Lenox Plastics, Inc.,** St. Louis, **(To page 232)**

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Mo., and **Lenox Plastics of Puerto Rico, Inc.** Both subsidiaries produce melamine dinnerware.

Leslie Brown, the former pres., is now chrmn. of the board.

Frank Ettner named tech. rep. in charge of sales to the plastics industry for **National Lacquer & Paint Co., Inc.**, Chicago, Ill.

Bruce Daugherty appointed regional sales mgr. for Midwestern Div. of **Filon Plastics Corp.**, with headquarters in Chicago, Ill.

James M. Selden appointed asst. to the pres. of **Shell Chemical Corp.** He was formerly asst. to VP—marketing.

Michael J. Elias, Jr. joined the sales staff of **Chemical Solvents, Inc.**, Newark, N. J.

Zavan T. Khachadoorian appointed VP in charge of production of **Cordo Chemical Corp.**, Norwalk, Conn.

Herbert H. Fink named VP-development of **B. F. Goodrich Industrial Products Co.**, div. of **The B. F. Goodrich Co.**

C. Leonard Johnson appointed sales mgr., **Synthane Corp.**, Oaks, Pa. He has been with Synthane since 1948.

Frederick G. Law elected a VP of **Columbian Carbon Co.** He is pres. of Fred'k H. Levey Co., Inc., a wholly owned subsidiary of Columbian.

Arthur H. Johnson named chief chemist of the Product Development Div. **G. T. Schjeldahl Co.** He will be especially concerned with development of plastic laminates for air-supported buildings and special fabrications.

John V. Drum appointed mktg. mgr. of the mechanical goods div., **U. S. Rubber Co.**, which includes plastics.

James E. Kennedy named to newly-created post of production mgr. of **Rubbermaid, Inc.**

Carl B. McLaughlin promoted from exec. VP to pres. of **Tube Turns Plastics, Inc.**, Louisville, Ky. He succeeds **George O. Boomer**, who is now chrmn. of the exec. committee.

John Duboveck named the new rep. in the Schenectady, N. Y. area for **General Electric**'s line of industrial laminated plastics.

New reps.

R. M. Elicker, P. O. Box 634, Far Hills Sta., Dayton 19, Ohio, appointed rep. for the Industrial Control Div. of **Sterling, Inc.**, Milwaukee, Wis.,

mfr. of Sterlco temperature control units. . . . **Marlyn Stockdale,** 3359 Fletcher Dr., Los Angeles, Calif., named Southern Calif. distributor for **Plastomatic Corp.,** Malvern, Pa., mfrs. of plastic bathroom sets and Date-Pak freezer containers. . . . **The Georgia-Pacific Corp.,** 3025 V St., N. E., Washington, D. C., appointed by **Formica Corp.,** subsidiary of **American Cyanamid Co.,** to handle distribution of Formica products in the Washington area. . . . **Northern Plastics Corp.,** LaCrosse, Wis., appointed **J. N. Powderly,** 167 Fairhaven Rd., Rochester 10, N. Y., rep. for New York state, and **Phelan-Tramelli Sales Agency,** 7206 Northmoor Dr., St. Louis 5, Mo., to cover southern Illinois, and eastern Missouri. . . . **H. V. Burton Co.** to rep. **Fred H. Schaub Engineering Co.,** Chicago, Ill., mfr. of boiler feed and condensate handling equipment in the Detroit area. . . . **M. J. Crose Mfg. Co., Inc.,** Tulsa, Okla., appointed distributor of the complete line of **Johns-Manville** fibrous glass pipeline products. . . . **Auto-Vac Co.,** div. of **National Tool Co.,** appointed **Robert Dean,** 109 Highgate Pl., Ithaca, N. Y. and **Joseph D. Robertson,** 3133 Maple Dr., N. E. Atlanta 5, Ga., sales reps. for the company's thermoforming machines. . . . **The Lustro Co.,** 1100 Mateo St., Los Angeles, Calif., named West Coast rep. for the complete line of metallized thermoplastic sheeting and laminations produced by **Gomar Mfg. Co.,** Linden, N. J. . . . **Filon Plastics Corp.,** El Segundo, Calif., appointed **Peninsular Supply Co.,** with offices at Miami, Fort Lauderdale, and West Palm Beach, Fla.; **Pyramid Products Co.,** Kansas City, Mo.; and **J & J Steel & Supply Co.,** Odessa, Texas as distributors for its RFP panels. . . . **Hastings Plastics, Inc.,** Santa Monica, Calif. appointed by **Colton Chemical Co.,** a div. of **Air Reduction Co., Inc.,** as West Coast distributors for Colfoam microballoon spheres. These spherical urea-formaldehyde particles, filled with an inert gas, are used as fillers in polyester, epoxy, PE, etc. Hastings was also named distributor by **Nuodex Products Co.,** a div. of **Heyden Newport Chemical Corp.,** for the company's line of organic peroxide catalysts and accelerators. . . . **A. M. Byers Co.** appointed **W. M. Pattison Supply Co.,** 777 Rockwell Ave., Cleveland, Ohio, and **Southland Supply Co.,** 2034 Amelia St., Dallas, Texas, distributors for PVC pipe. . . . **Eric I. Ludmer,** 5580 Glencrest Ave., Montreal, P. Q., named Canadian rep. for **Commercial Plastics & Supply Corp.** . . . **A. M. Castle Co.,** Franklin Park, Ill., with warehouses in Baltimore, Md.; Cleveland, Ohio; Chicago, Ill.; San Francisco and Berkeley, Calif.; and Seattle, Wash., named distributors for the Plastics Div. of **Seiberling Rubber Co.** . . . **L. A. Weil Co.,** 53 Park Pl., New York, N. Y., will represent **Schwartz Chemical Co., Inc.,** Long Island City, N. Y.—**End**

CLASSIFIED ADVERTISEMENTS

EMPLOYMENT • BUSINESS OPPORTUNITIES • USED OR RESALE EQUIPMENT

Machinery and Equipment for sale

FOR SALE: Ovens, Grinders, Powder Mixers, Injection Molding Machines 1 oz. to 60 ozs. never used and used. Two-head Bottle Blowing Machine. Acme Machinery & Mfg. Co., Inc., 20 South Broadway, Yonkers, N.Y. YOnkers 5-0900, 102 Grove Street, Worcester, Mass. PLeasant 7-7747. 5222 W. North Ave., Chicago, Ill. TUxedo 9-1328.

MOST MODERN PACKAGING AND PROCESSING MACHINERY: Available at great savings; Package Machinery, Hayssen, Scandia Wrap King, Miller Wrappers, Pneumatic Scale Automatic Carton Feeder, Bottom Sealer, Wax liner, Top Sealer with interconnecting Conveyors. Pneumatic Scale Tite Wrap. Fitzpatrick Model D-6 Stainless Steel Comminuters. J. H. Day and Baker Perkins 50 and 100 gal. Steam Jacketed Steel and Stainless Steel Double Arm Mixers. Day, Robinson 50 to 10,000 lbs. Dry Powder Mixers. Jacketed and Unjacketed Werner & Pfleiderer 3,000 gal. and 3,500 gal. Jacketed Double Arm Mixers Baker Perkins, from 2 to 100 gal., Double Arm Mixers. Jacketed and Stainless Steel. Colton 2RP, 3RP, 3B, 5½T Tablet Machines. Stokes DD2 and Eureka Tablet Machines. Complete Details and Quotations Promptly Submitted. Union Standard Equipment Company, 318-322 Lafayette Street, New York 12, N. Y. Phone: CAnal 6-5334.

FIRST CLASS EQUIPMENT FROM YOUR FIRST SOURCE: Unused F-B. 2 Roll Plastic or Rubber Mills, 14" x 30" complete; Baker Perkins Heavy Duty Jktd Mixers up to 500 Gal.; Special 300 Gal. Stainless Vacuum Mixers, Sigma Arms; Bot. discharge; 250 Ton Self Contained Laminate Press; F.-B. 3 Roll Calender 8" x 16" compl; Preform Presses, Rubber Cutters etc. First Machinery Corp., 209 Tenth St., Brooklyn 15, N.Y. Phone ST-8-4672.

FOR SALE: H.P.M. Rubber Injection molders, 21½" x 28" mold space, steam heated platens. Watson-Stillman 300 ton semi-automatic compression molding press (1947) self-contained mold size 34"x27". Watson-Stillman 250 ton 28"x24". Watson-Stillman 140 ton 22"x16". Waterbury Farrel 85 ton 20"x24". Laboratory presses—15 ton 10"x8" and 10 ton 6"x6" platens. (1) 8 ounce Lester Phoenix Injection Molder (late) with nylon attachment. Scrap cutters. Presses—all sizes. Aaron Machinery Co., Inc., 45 Crosby St., New York, N.Y. Tel.: WAlker 5-8300.

LARGE BED PRESSES: Francis 485 Ton with three 14" diameter upmoving rams; 128" R to L, 25" F to B; completely self-contained unit with Hi-Lo Pumping system. Adamson 500 Ton with eight 9" diameter upmoving rams; eight strain rods; two steam heated 72" x 96" platens. 225 Ton Alliance; two 13" diameter upmoving rams; 41" x 84" platen area. Also in stock for immediate shipment; 1½" NRM extruder; 12 oz. Reed Prentice injection molder, 2 years old; 36", 40", and 60" mills; a complete line of ovens, blenders, mixers, preheaters, mills, injection molders, presses, scrap cutters, etc., for the rubber and plastic industry. We will finance. Johnson Machinery Co., 683 Frelinghuysen Ave., Newark 12, New Jersey, BIgelow 8-2500.

FOR SALE: 2 NRM 2½" electrically heated extruders, 10 HP; 22" x 60", 14" x 30"—2 roll plastics mills; 1 Cumberland 7" stair step dicer; 3 compression molding presses, 470, 200 and 42 tons; 2 Ball & Jewell rotary cutters, 2, 5 HP; also blenders, preform presses, mixers, etc. Chemical & Process Machinery Corp., 52 9th Street, Brooklyn 15, N.Y. HY 9-7200

NEW STAUDE AUTOMATIC ACETATE BOX MACHINE: Sacrifice for cash or easy terms to responsible party. Will trade for slitter or other plastic fabricating machinery. Reply Box 5802, Modern Plastics.

FOR SALE: Wat. Still. 240 ton, ten-24" x 56" platens. Baldwin-Southwark 200 ton semi-automatic transfer molding press. French Oil 250 ton 38" x 28". 225 ton 16" record presses. French Oil 120 ton self-contained. Hydraulic pumps and accumulators. New ¾ oz. Bench model Injection Machines. Van Dorn 1 to 2½ ounce. Lester 16 oz. Other sizes to 100 oz. Baker-Perkins and Day jacketed mixers. Ball & Jewell #2 Plastic Grinders and other sizes. Seco 6" x 12" and 8" x 16" mills and calenders. Farrell Birmingham 14" x 30" two roll mills. Hartig 3¼" Plastic Extruder. Single and Rotary preform presses ½" to 4". Partial listing. We buy your surplus machinery. Stein Equipment Company, 107-8th Street, Brooklyn 15, New York.

FOR SALE: Complete moulding equipment for producing expanded polystyrene blocks measuring approximately 9" x 18" x 36" also hot-wire cutter for the same. Reply Box 5801, Modern Plastics.

FOR SALE: 43—Baker-Perkins #17, 200 gal. jacketed mixers, sigma and duplex blades, many with individual 30 HP motors and drives, power-screw tilts. 2—Baker-Perkins 100 gal., sigma or dispersion blades, jacketed. 3—Baker-Perkins 50 gal., sigma blades, jacketed. 2—J. H. Day 35 gal. sigma blade. Perry Equipment Corp., 1429 N. 6th St., Phila. 22, Pa.

FOR SALE: One Baker 30 ton fully automatic Molding Press—three oz. Fellows Injection Machines—Plastic Mixers and Grinders—Carver Laboratory Presses and others up to 75 ton—¾" 3000 psi Double Solenoid and Cam Operated Hydraulic Valves—Laboratory Mills. Plastic Machinery Exchange, 426 Essex Ave., Boonton, N.J.—Tel.: DEerfield 4-1615.

FOR SALE: Abbott Skin-Pack Machine, 2 station, 30" bed, all controls; Reeves Model C9E-S Electronic Sealer 3KW. Both like new, Reasonable. H. H. Hixson & Co., 1218 N. Halsted St., Chicago.

POWDER BLENDERS: 10,000 lbs. Lab. Mill 6 x 16. Baker Perkins 150 gal., 2 arm, 40 HP; 100 gal., 2 arm, 50 HP, S.S. jacketed vacuum hydr. tilt. Stokes-3 DDS2, 2 DS3. Calender 6 roll 5" x 12". 1,000 ton Hobbing Press. Ball Mill. Hyd. Pumps. Machinecraft Corp., 800 Wilson Ave., Newark 5, N.J.—Mitchell 2-7634.

FOR SALE: 1—Baker Perkins 100 gal. Sigma blade Mixer; 1—Baker Perkins size 16 TRM, 150 gal. double arm, vacuum Mixer; 1—Ball & Jewell #1 Rotary Cutter; 1—Kent 6" x 14" three roll Mill; 6—Stokes Model DD2, DS3, D3 and B2 Rotary Preform Presses; 4—Stokes Model "R" single punch Preform Presses. Also: Sifters, Banbury Mixers, Powder Mixers, etc., partial listing; write for details; we purchase your surplus equipment. Brill Equipment Co., 2407 Third Ave., New York 51, N. Y.

Machinery wanted

WANTED TO PURCHASE: Used 27 x 36 Wheelobrat or Tumblast, which was used for deflashing bakelite. Eagle Plastics Corp., 24-02 Bridge Plaza So., L.I.C., N.Y.

STOKES PRESSES WANTED by Eastern Molder. Reply Box 5813, Modern Plastics.

WANTED: BAKER PERKINS heavy duty jacketed, double arm, sigma blade mixers. RPM, Inc., 43 34th Street, Brooklyn 32, N.Y. STerling 8-1550.

WANTED TO BUY: Used injection molding machines, oven, granulators. One machine or complete plant. Acme Machinery & Mfg. Co. Inc., 20 South Broadway, Yonkers, N.Y. YOnkers 5-0900, 102 Grove Street, Worcester, Mass., PLeasant 7-7747, 5222 West North St., Chicago, Illinois, TUxedo 9-1328.

Materials wanted

WANTED: All types of plastic scrap and surplus inventories such as: styrenes, butyrates; acetates, acrylics and polyethylenes in any form. Write, Wire or Phone Collect. Humboldt 1811. Philip Shuman & Sons, 15-33 Goethe Street, Buffalo 6, New York.

NYLON SCRAP WANTED: by reprocessor. All kinds including molding, extrusion and fabricating. Quotations promptly furnished on all grades and polymer types. Adell Plastics, Inc., 5208 Eleanora Avenue, Baltimore 15, Md.

WANTED: Plastic of all kinds—virgin, reground, lumps, sheet and reject parts. Highest prices paid for Styrene, Polyethylene, Acetate, Nylon, Vinyl, etc. We can also supply virgin & reground materials at tremendous savings. Address your inquiries to: Gold-Mark Plastics Compounds, Inc., 4-05 26th Ave., Long Island City 2, N. Y. RAvenswood 1-0880.

GET THE TOP MONEY FOR PLASTIC SCRAP: Now paying top prices for all thermoplastic scrap. Wanted: polystyrene, cellulose acetate, vinyl, polyethylene, butyrate, acrylic, nylon. All types and forms including rejects and obsolete molding powders. Fast action wherever you are located. WRITE, WIRE TODAY! Reply Box 5800 Modern Plastics.

WANTED: Vinyl and Polyethylene Scrap. Send description and small sample. We are continuous buyers. American Vinyl Corp., 73-30 Grand Ave., Maspeth 78, N.Y. Tel.: DEfender 5-9200.

POLYETHYLENE WANTED—will purchase virgin, scrap, and off grade polyethylene, natural and colors in injection molding and extrusion grades. In reply, state price, melt index, quantity available and shipping point. Reply Box 5814, Modern Plastics.

Materials for sale

MATERIALS FOR SALE: Mixed Colored Cellulose Acetate. Will convert into black or dark color. Also—offer us your surplus compounds and plastic scrap. Claude P. Bamberger, Inc., Ridgefield Park, N.J. HUbbard 9-5330.

GENERAL PURPOSE, MEDIUM AND HI-IMPACT POLYSTYRENE AND POLYETHYLENE molding materials for sale in any color or quantity. Packed in 50 lb. bags. Now at our lowest prices in years. For top quality materials, at big savings, write: Gering Plastics division of Studebaker-Packard Corp., Kenilworth, New Jersey, Department M. Or call: (N.J.) BRidge 6-2900.

REPROCESSED NYLON FOR SALE: Reprocessor offers highest quality pelletized nylon in all common resin types. Natural and black available from stock. Custom colors compounded on request. Samples and quotations promptly furnished. Adell Plastics, Inc., 5208 Eleanora Avenue, Baltimore 15, Md.

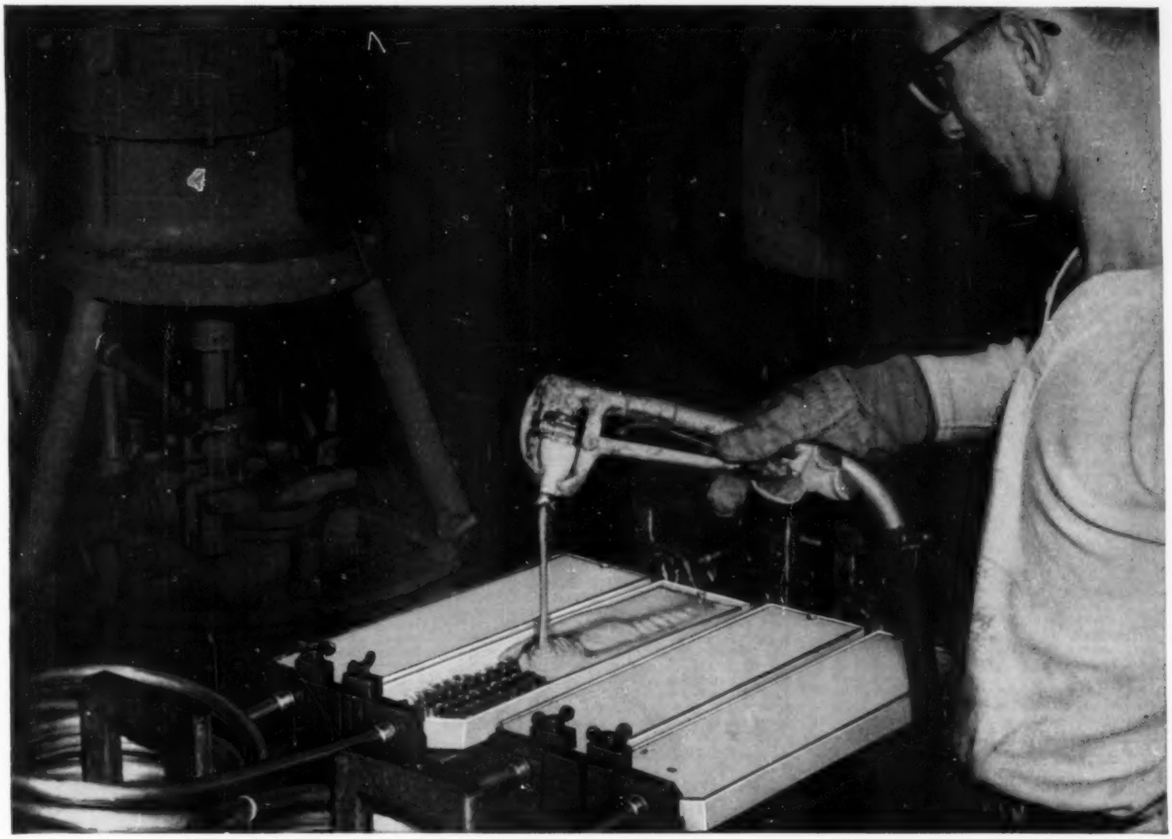
Help wanted

PERSONNEL: Executive—Technical—Sale—Production. Employers and Applicants—whatever your requirements, choose the Leader in Personnel Placement. Cadillac Associates, Inc., Clem Easly—Consultant to Plastics Industry, 29 E. Madison St., Chicago, Ill.—Wabash 2-4800. Call, write or wire—in confidence.

OUTSTANDING OPPORTUNITY: Fiberglass Production Manager and Exper. Tooling, Mold & Pattern-Makers needed for recently expanded, established fiberglass boat manufacturer. State experience, age, salary requirements in first letter. Luger Industries, Inc., 9200 Access Rd., Minneapolis 20, Minn.

PLASTICS FOREMAN: Experienced Compression Molding. Progressive N. Y. Company. Good Salary and bonus, other benefits. Reply Box 5812, MODERN PLASTICS.

(Continued on page 236)



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PRODUCTION MANAGEMENT OPPORTUNITIES: Expanding Division of multi-plant national company, offers unusual opportunities in film extrusion engineering, plant supervision, quality control, flexographic and rotogravure printing, machine designers. These are growth positions for responsible, ambitious men with America's Oldest Bag Maker. Reply to: Plastics Division, Chase Bag Company, 155 East 44th St., New York 17, New York.

WANTED: Experienced foreman or superintendent thoroughly conversant all aspects of compression molding. Location Chicago. Extremely progressive company. Excellent starting salary and further incentive compensation. Good future assured right man. Reply Box 5803, Modern Plastics.

PRODUCT DEVELOPMENT ENGINEER: Flexible Packaging. BS in chemistry or physics from first-rate school. Over 30. Laboratory experience in flexible packaging field. At least 3 years industrial experience in laboratory or field work. Extrusion coating and lamination experience desirable. Right man offered unlimited opportunity and excellent future management possibility with large nationally-known organization. Headquarters, New York City. 15-25% travel. For convenient interview send resume and salary requirements to Box MPL 1670, 125 W. 41st St., New York, N.Y.

WANTED: Thoroughly experienced extruder operator with good knowledge of machinery. Capable of assuming responsibility. Rare opportunity for the man we are looking for. Must be willing to relocate in pleasant small community in Connecticut. State full qualifications, age and experience in first letter. All replies held in strict confidence. Reply Box 5804, Modern Plastics.

INJECTION MOLDING ROOM FOREMEN AND LEADMEN: Leading Southwest injection molder needs your help, you too, can live in this land of opportunity under excellent working conditions and benefits. We will move qualified persons. Should be thoroughly experienced in operation of injection presses, capable of leading men, and apt in the handling of paperwork connected with modern foremanship. Tell us about yourself and family. Write full work history, education, and desired starting salary to: Loma Plastics, Inc., 3000 W. Pafford, Ft. Worth, Texas. If qualified, you will receive an immediate reply and arrangements will be made for interview.

PLASTICS CHEMIST OR CHEMICAL ENGINEERS: Excellent opportunities in a moderate sized company and a rapidly growing market. Up to 10 years experience in molding, extrusion and related research, development or customer service preferred. Please send resume to J. H. Saunders, Director of Research, Mobay Chemical Company, New Martinsville, West Virginia.

RIGID VINYL APPLICATIONS: Chemical Engineer to do application and development work in rigid vinyl compounding and fabrication. Permanent, responsible position. Pleasant New England location, 43 miles from Boston. Reply in confidence to: Borden Chemical Co., 60 Elm Hill Ave., Leominster, Mass. Att. Mr. E. Linsky.

WANTED: PLASTIC CHEMIST. Prefer man with experience in Polyethylene, Polypropylene and Polystyrene. Polyolefin experience most desired. Work entails quality control, blends of plastics, color matching, research and development work. Please list past experience and salary desired. Reply Box 5805, Modern Plastics.

MIDWEST MANUFACTURERS REPS WANTED: by long established custom molder and extruder with 750 employees seeking representatives in several midwestern States for Injection, Compression, Transfer, and polyester glass premix molding service plus extruded sheets and shapes. Want reps now selling components to industrial accounts. You bird dog—we follow with engineer. Commission basis. Reply in detail. Box 5809, Modern Plastics.

TECHNICAL OPENINGS IN GROWTH COMPANY: Hooker Chemical Corporation sales have increased tenfold since World War II. Its management is dedicated to a policy of continuing vigorous growth through research. Challenging opportunities exist for research oriented scientists with superior academic backgrounds or experience. The new Centralized Research Department, located in a new laboratory on beautiful Grand Island near Niagara Falls, New York, has current openings for scientists with doctoral training or equivalent experience for exploratory, fundamental and application type research. Major fields include such areas as organic and inorganic phosphorus compounds, plastics and polymers, and halogen and sulfur containing organic compounds. Salaries are commensurate with ability and experience. Liberal program of benefits. Send a resume or write for an application form. Technical Recruiter, Hooker Chemical Corporation, Niagara Falls, New York.

REINFORCED MOLDING PERSONNEL: for fibre glass boats and other products. A new operation being planned—we are seeking personnel for all levels—administrators, engineers, designers, salesmen, production personnel. Reply Box 5806, Modern Plastics.

PLASTICS ENGINEER: Research and development work in thermoplastic extrusion and fabrication. Creative ability and experience in current methods and materials required. Excellent opportunity in extended program for qualified person. Young, aggressive organization with select standards and corresponding benefits. Modern equipment and facilities in growing Boulder, Colorado. Mail resume to: Box 5807, Modern Plastics.

WANTED PLASTIC PRODUCTION MANAGER: AA1 manufacturer offers unusual opportunity to a production specialist, capable of taking full responsibility of a new compression molding division molding large parts from thermoplastic, phenolic and resin impregnated woodflour material. Must be able to train new personnel in molding and finishing techniques. Experience in painting the plastic parts is helpful, but not necessary. Send complete details of education, experience, salary requirements, etc. to Box 5808, Modern Plastics. All information received will be kept confidential.

EXTRUSION EXPERT—If you know extrusion practice and theory, our research-minded company can offer you an unusual opportunity in polymer research and development. We want a chemist or chemical engineer who is experienced in the art of extrusion of plastics and knows screw design and extrusion theory. Write: Standard Oil Company Indiana, T. G. Stack, PO Box 431M, Whiting, Indiana.

PLANT MANAGER for melamine molding powder plant in a high staffed position reporting directly to the Vice President. Thorough knowledge of both modern process and machinery is required. Confidential. Reply Box 5810, Modern Plastics.

NYLON PRODUCT SALES MANAGER: For a leading producer of Type 6 Nylon molding-extrusion materials. The man we are looking for must have field selling experience in plastics, with emphasis on end-use selling. He will operate out of our home office in New England, will travel on a national basis and will assume immediate responsibility for the Company's Nylon sales program. Salary commensurate with background—plus bonuses. To the right man, this very-much-in-the-news growth Company offers an unexcelled opportunity for going places. Our staff knows of this ad. Your reply will be held in strict confidence. Reply Box 5831, Modern Plastics.

WANTED: YOUNG MAN FOR SALES In packaging field, New York office. Good opportunity. College graduate preferred. Salary, bonus, expenses paid. Send resume experience and education. Replies confidential. Reply Box 5811, Modern Plastics.

VINYL COATED FABRICS CHEMIST: B.S. in Chemistry or Chemical Engineering. Experience in all phases of compounding plastisols and organasols essential. Knowledge of Adhesives, and general line of polymers applicable to coated fabrics desirable but not necessary. Excellent opportunity for advancement in a medium sized progressive company. Send detailed resume of background and experience, including salary requirements. All replies will be treated with strict confidence. Reply Box 5832, Modern Plastics.

GENERAL SALES AND PLANT MANAGER—Recently organized and newly equipped extrusion plant in Eau Claire, Wisconsin, has promising executive management opportunity for person with Polyethylene Extrusion experience and sales ability. Excellent starting salary. Contact: Percy Ross, President; Indianhead Plastics, Inc. Main Office: 3954 Wooddale Avenue, Minneapolis 16, Minnesota. Telephone: WAlnut 7-9997.

FILM EXTRUSION PLANT MANAGER: For polyethylene lay flat tubing. An unusual opportunity in New England with progressive established extruder. Good administrator and experienced technician required. Excellent starting salary and future. Write in confidence. Reply Box 5834, Modern Plastics.

PLANT MANAGER—PLASTICS FILM EXTRUSION: Leading Eastern Polyethylene Film Extruder is opening new ultra modern branch plant in the Chicago area. Need highly capable young man to take full charge of this operation. Experienced in the field desirable, but not essential. Prefer Engineer. Excellent opportunity with growth company in growth industry. Reply Box 5833, Modern Plastics.

Situations wanted

MANUFACTURERS OR SALES AGENT: 15 years molding experience. Complete knowledge molders-extruders metropolitan area-N.J.-Conn. Wishes to represent firm manufacturing Products used by molders & extruders. Reply Box 5823, Modern Plastics.

PLANT MANAGER: fiberglass reinforced plastic sheet. Six years experience in high and low pressure laminating. Production of mat for both operations. Ten years experience in production of resins. Desires position in New York-New Jersey area. Reply Box 5819, Modern Plastics.

TECH. REPRESENTATION AVAILABLE Established manufacturers agency, headquartering in Chicago, and now calling upon Midwest formulators, molders and decorators, desires an additional established line. Reply Box 5815, Modern Plastics.

EXECUTIVE ASS'T: V. P. Injection molding 16 years. Complete knowledge Purchasing Production-Estimating-Sales. Seeks Position with Progressive Molder. Reply Box 5822, Modern Plastics.

MANUFACTURERS' REPRESENTATIVE: established, experienced and successful, desires to represent decorative & injection molded plastics mfgr. who can be competitive in automotive & appliance industry. Reply Box 5817, Modern Plastics.

PRODUCTION MANAGER: 37, BS, MBA, 16 years experience includes shop work, production control, inventory control, purchasing, operations and cost analysis in the injection, rotational and blow molding fields, desirous of obtaining position that will enable the use of past experience and offer the opportunity to expand background. Reply Box 5816, Modern Plastics.

(Continued on page 238)

Changing the density?

Changing the resin?

Changing the product?...

NO PROBLEM

with HARTIG equipment

Hartig 3½" Extruder
L/D Ratio, 21:1
Effective Screw Length: 73½"
Nominal Capacity: 200-250 lbs./hr.
Barrel Heat: 13 bands, 2500 W ea.
Control Zones: barrel 3, die 1
Temperature Controls: 4 (proportioning)
Thrust Bearing Capacity: 221,900 lbs.
Floor Dimensions: 111" x 70" (belt drive)
Weight (approx.): 5000 lbs.
Motor Drive (belt): 25-40 hp.

Each Hartig extruder has been designed to do a specific job – at maximum efficiency. It has also been designed so that a new job setup can be handled at equal efficiency with only minor modifications.

Motor, drive, base, barrel and controls need not be changed. Screws suitable for processing the various new materials are readily interchangeable. Quick opening clamp type head, a Hartig first, makes die change fast and easy.

When you buy a Hartig extruder, you can be sure of the highest production rate for each job—for years to come. Let us show you the facts and figures.

Send for your copy
of the new illustrated booklet describing the line of Hartig Extruders and Matched Auxiliary Equipment.

HARTIG
EXTRUDERS

Division of Midland-Ross Corporation
MOUNTAINSIDE, NEW JERSEY

(Continued from page 236)

GENERAL MANAGER: M. E. Degree-Extensive Experience all phases Injection Molding-Development Engineering Production & Planning, Purchasing, presently employed. Desire change to progressive growth company. Reply Box 5820, Modern Plastics.

PLASTIC ENGINEER: Ph.D., Chemical Engineer, P.E., married, five years diversified process development experience in extrusion and orientation of thermoplastic films, dispersion coating and polymerization. Have proper balance of practical and theoretical with talent for process development. Desires supervisory position with dynamic organization. Reply Box 5818, Modern Plastics.

FOREMAN, PLASTIC MOLDING: 16 yrs. experience mold and press maintenance, set-up and press operation: injection, compression, transfer, rotary. Graduate I.C.S. Plastics Production Foreman course. Best references. Philadelphia area preferred. Reply Box 5821, Modern Plastics.

PROFESSIONAL PLASTICS ENGR.: 10 years of extensive practical experience in extrusion, vacuum forming, polyester laminates production, plant setup, technical sales and service desires executive position in plants located in Latin America. Past earnings $10,000. Reply Box 5826, Modern Plastics.

Miscellaneous

MODERN INJECTION MOLDING PLANT FOR SALE: 7 machines, 8 oz. to 16 oz. complete with all accessories for modern production. Full refrigeration; weigh feeders; mold temp controls; 18,000 square feet; New York City; available early 1960. Reply Box 5824, Modern Plastics.

BUYER WANTED: Individual having had 20 years experience in all phases on Vinyl Coatings field has small coatings plant, with excellent formulations; which can be taken over for tax loss. Reply Box 5828, Modern Plastics.

WANT TO PURCHASE: Modern injection molding plant, 6 to 10 machines; in Connecticut, New Jersey or Metropolitan New York. Occupancy 1960. Reply Box 5825, Modern Plastics.

LICENSE RIGHTS to manufacture the original adjustable safety razor covered by U. S. and Canadian letters of Patent open to offers. The design of this invention is very simple with a minimum amount of moving parts and can be readily molded or die cast. Enquiries to B. Erickson, 327 E. 18th Ave., Vancouver 10, B. C., Canada.

WANTED: PLASTIC MAUFACTURER OR INVESTOR to provide funds for manufacturing child's plastic toy. Will retail under $1.00. Every child between 3 and 8 years is a potential customer. Product also makes ideal self-liquidating premium for Cereal-Soap Toothpaste or Toothbrush manufacturer. Five-year test showed parents enjoyed this toy as much as children. Toy will be injection molded and vacuum metallized. Reply Box 5830, Modern Plastics.

WANTED TO BUY—For cash—A 50% interest in an injection molding plant in Chicago area. Will devote full time and have good contact with an aggressive selling organization in food packaging field. Reply Box 5829, Modern Plastics

EUROPEAN PLASTICS MARKET: A group of highly rated license partners with independent factories in Germany, Austria, Belgium, France, Italy, Spain, Sweden, Switzerland and very efficient marketing organizations in all countries of Western Europe except U.K., seeks cooperation with highly rated American manufacturers of plastic products. We are interested in selling and/or manufacturing under license any plastic product, duroplast as well as thermoplast, promising big volume, in any or all of the above countries. No gadgets or gimmicks, please. Your reply should include ample informations and will be treated in strictest confidence. During September an executive of one of our companies will be in the U.S. for personal contacts. Reply Box 5827, Modern Plastics.

WANTED TO BUY: Full or half interest in small injection molding operation. State particulars. Reply Box 5835, Modern Plastics.

RATES FOR CLASSIFIED ADVERTISING

All classified advertisements payable in advance of publication

Closing date: 10th of preceding month, e.g., September 10th for October issue

Per inch (or fraction) .... $30.00; each 3 inches or fraction (in border) $15.00 extra

Situations Wanted Ads .... 1/3 of above rates

For purpose of establishing rate, figure approximately 50-55 words per inch.

For further information address Classified Advertising Department

Modern Plastics, 575 Madison Avenue, N. Y. 22, N. Y.

Modern Plastics reserves the right to accept, reject or censor classified copy.

INDEX OF ADVERTISERS

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MODERN PLASTICS
A BRESKIN PUBLICATION
PUBLISHED BY BRESKIN PUBLICATIONS INC. 575 Madison Avenue, New York 22, N. Y.

EDITORIAL

Aluminum will give us fierce competition!

Like a giant awakened from slumber, the aluminum industry is hungry—for markets—any markets.

Free-world production of aluminum increased last year from 3.6 million tons to 4.1 million tons, a 14% rise that has actually created a glut in capacity.

So the aluminum industry is expanding it sales, public relations, and promotional programs on a scale that dwarfs all precedent.

The packaging field, the building field, the automotive field, the appliance field are the first to feel the impact of this new market aggressiveness.

Steel's present markets are a main target, but so are many of plastics' present markets, particularly in large area and structural components. Emphasis will be on strength-weight ratios, on flame resistance, on color and texture, on low tool costs per piece produced.

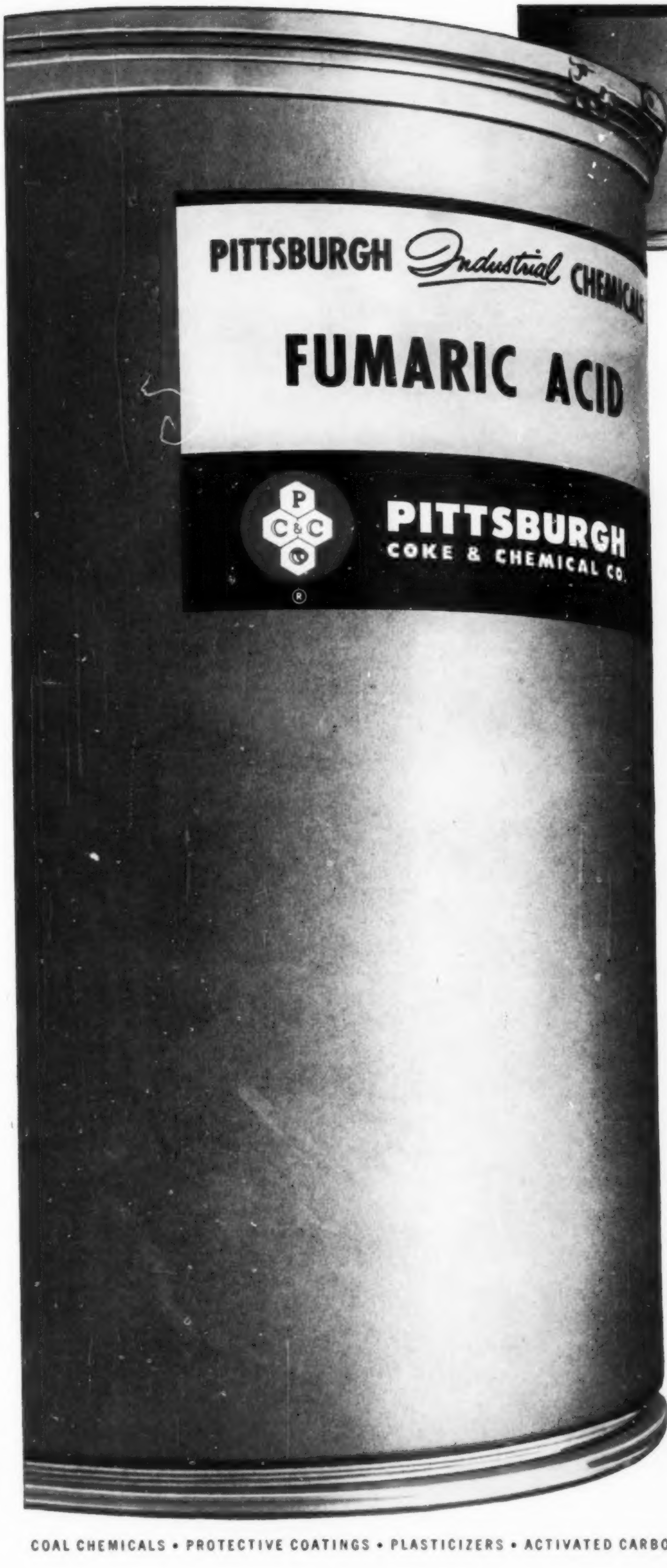
And, as has happened before, the aluminum people will not hesitate to go into plastics. Where they can't beat us, they'll join us. Vinyl-coated aluminum is already under test for construction siding; aluminum laminated to films is being used in automotive parts, luggage, housings, and appliances; foil-film combinations are coming along fast.

So in combination with aluminum, plastics can have some opportunity in a growing total market.

But let's not forget that the aluminum industry is out to sell its glutted capacity—not to sell plastics. And, as an industry, it is getting set to spend promotion money at a rate and at a pace that makes the plastics industries' expenditures on overall promotion look like peanuts!

Hiram McCann

Modern Plastics Executive and Editorial Offices: 575 Madison Avenue, New York 22, N.Y. Tel.: PLaza 9-2710; TWX: NY 1-3063; Cable address: BRESKINPUB.



A New Basic Source of High Purity

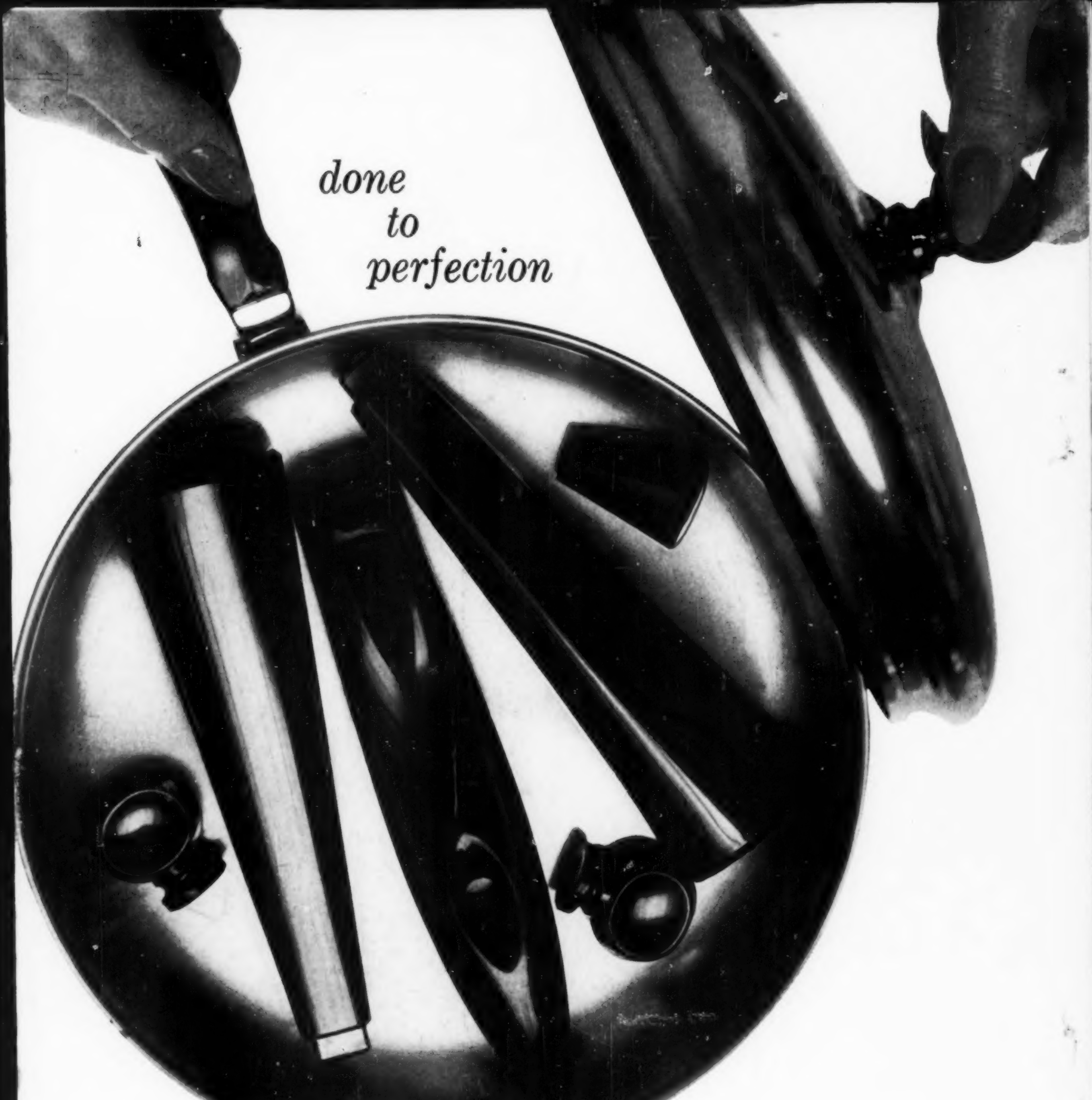
FUMARIC ACID

Pittsburgh Coke's new Fumaric Acid plant is now in full production. This modern, integrated facility permits complete production control, from coal to finished acid.

The advantages to *you?* A high-purity, free-flowing product that helps maintain efficient, trouble-free production in your plant. Plus the assurance of on-schedule deliveries and alert technical service—right in your plant when necessary. Call Pittsburgh Coke for *your* next shipment of Fumaric Acid!

WSW 7367

COAL CHEMICALS • PROTECTIVE COATINGS • PLASTICIZERS • ACTIVATED CARBON • COKE • CEMENT • PIG IRON • FERROMANGANESE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